



INDIAN AGRICULTURAL
RESEARCH INSTITUTE, NEW DELHI.

I. A. R. I. 6.

MGIPC—SI—6 AR/54—7-7-54—10,000.

TRANSACTIONS
OF THE
Royal Canadian Institute



Volume XIX, Parts I and II, and Supplement

No. 41, Part I—Pages 1 to 139 (1932)

No. 42, Part II—Pages 141 to 299 (1933)

CONTENTS

| | |
|---|-----|
| Revision of the North American Species (North of Mexico) of the Genus <i>Haliplus</i> | 1 |
| J. B. WALLIS | |
| Collembola of the Toronto Region with Notes on the Biology of <i>Isotoma palustris</i> Mueller | 75 |
| H. G. JAMES | |
| Some Observations on the Albatrosses and Other Birds of the Southern Oceans | 115 |
| C. C. DIXON | |
| Calanoid Copepoda of Bermuda | 141 |
| KATHLEEN G. PINNEY | |
| Geological Section in Crowsnest Pass, Rocky Mountains | 145 |
| P. S. WARREN | |
| History and List of the Birds of Middlesex County, Ontario | 161 |
| W. E. SAUNDERS AND E. M. S. DALE | |
| Flowering Plants and Ferns of Prince Edward Island | 251 |
| BLYTHE HURST, SENIOR | |
| List of the Larger Fungi of the Toronto Region | 275 |
| GARNET S. BELL | |
| The Future of the Canadian Export Trade in Wheat—Supplement to Vol. XIX. | |
| D. A. MACGIBBON | |

OFFICERS

OF

The Royal Canadian Institute

1933-34

Honorary Patron

HIS EXCELLENCY THE EARL OF BESSBOROUGH

P.C., G.C.M.G.

GOVERNOR-GENERAL OF CANADA

Honorary Vice-Patron

THE HONOURABLE HERBERT A. BRUCE

M.D., F.R.C.S., LL.D.

President

SIR ROBERT FALCONER

K.C.M.G.

1st Vice-President

PROF. J. ELLIS THOMSON, PH.D.

2nd Vice-President

PROF. J. W. BAIN, B.A.Sc.

| | | | | | | |
|-----------|---|---|---|---|---|--------------------------------|
| Secretary | - | - | - | - | - | PROF. J. R. DYMOND, M.A. |
| Treasurer | - | - | - | - | - | FREDERICK WINNETT, Esq., M.D. |
| Editor | - | - | - | - | - | PROF. E. M. WALKER, B.A., M.B. |
| Librarian | - | - | - | - | - | PROF. H. A. INNIS, PH.D. |
| Curator | - | - | - | - | - | H. JEWELL, Esq. |

Members of Council

DR. HAROLD CLARK
A. R. CLUTE, K.C., LL.B.
M. L. DAVIES, Esq.
MRS. D. A. DUNLAP
GEORGE C. GALE, Esq.
ARTHUR HEWITT, Esq.
PROF. A. G. HUNTSMAN, B.A., M.B.
SIGMUND SAMUEL, Esq.
PROF. H. B. SIFTON, PH.D.
MRS. H. D. WARREN

Ex-officio

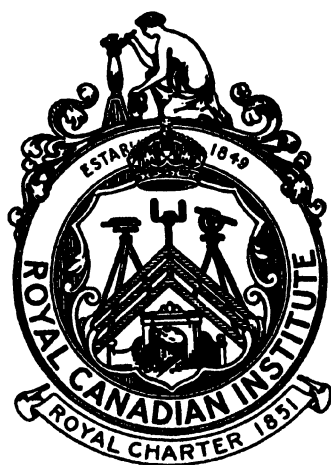
JOHN PATTERSON, Esq., M.A.
PROF. E. F. BURTON, PH.D.
T. A. RUSSELL, LL.D.
PROF. R. B. THOMSON, B.A.
PROF. W. A. PARKS, PH.D.

TRANSACTIONS
OF THE
Royal Canadian Institute

No. 41

MAY, 1933.

VOL. XIX, PART I



REVISION OF THE NORTH AMERICAN SPECIES, (NORTH OF MEXICO), OF THE GENUS *HALIPLUS*, LATREILLE

By J. B. WALLIS
Winnipeg, Man.

Nineteen years ago Mr. Robert Matheson published a paper, "The Haliplidae of North America, North of Mexico," in the Journal of the New York Entomological Society, Volume XX, Number 3, September 1912. In this paper Mr. Matheson not only revised the genera of *Haliplidae* but also gave some valuable biological information in regard to some species.

Unfortunately, Mr. Matheson did not have before him sufficient material in the family to enable him to cover the subject adequately, so that in less than a year Mr. C. H. Roberts was able to add some fifteen new species to those listed by Mr. Matheson and, in addition, to point out several incorrect identifications in the earlier paper.

Mr. Roberts' work, "Critical Notes on the Species of *Haliplidae* of America, North of Mexico," in the "Journal of the New York Entomological Society, Volume XXI, Number 2, June, 1913," was marked by keen discrimination, patient study of long series and careful comparisons and descriptions so that but few of his conclusions need revision. From the fact, however, that he had been unable to recognize some of Mr. Matheson's species, Mr. Roberts felt himself unable to issue a key to *Haliplus* so that students of the genus have been compelled to use Mr. Matheson's, supplementing it by a study of Mr. Roberts' "Notes."

More recently Dr. Alois Zimmermann of Munich, Germany, published an account of the species represented in certain German museums under the title "Die Schwimmkäfer des Deutsch. ent. Mus. in Berlin Dahlem," in the "Archiv. für Naturgeschichte, 1917 (1919)." He followed this by a monograph "Die Halipliden der Welt," in "Entomologische Blätter, XX, 1924," in which he changed some of his previously expressed opinions and described two species of *Haliplus* from North America as new.

The papers by the three authors mentioned form a very satisfactory basis for further study especially of species, and Dr. F. Guignot of Avignon, France, has shown how the genus *Haliplus* may be divided into sub-genera. In "Annales de la Société Entomologique de France, Volume XCVII, 1928, pp. 138-9" he divided the genus into four sub-

genera, and to these he added a fifth in a paper in the "Bulletin de la Soci  t   Entomologique de France, 1930, No. 4."

Of these five sub-genera, three only are found in the North American fauna but as the original may not be available to all North American students I give below a translation of Dr. Guignot's table.

1. Posterior tibiae without a longitudinal striole upon their internal face. (Fig. 1b.)
2. The body above and below completely covered with dense punctulation, (tertiary punctulation) *Haliplidius*, Guig.
- 2'. Punctulation nearly wanting, and reduced to a few very sparse punctures scattered along the elytral intervals.
3. Pronotum marked on each side with a longitudinal basal plica.
4. Posterior tibiae with superior marginal row (of setae) regular to the apex, prosternal process with distinct transverse margin at base. Parameres furnished with hairs in funnel. *Neohaliphus*, Netol.
- 4'. Posterior tibiae with superior marginal row (of setae) divided into two towards the summit, prosternal process not margined at base (exceptionally a trace of margin in one species: *japonicus*).
Haliphus, s. str.
- 3'. Pronotum without lateral longitudinal basal plicae.
Paraliaphlus nov. subg.
- 1'. Posterior tibiae with a longitudinal striole upon their internal face. (Fig. 1a). Pronotum always without lateral plicae. . . *Liaphlus*, Guig.

From an examination of this key it will be seen that our species fall into one or other of the last three sub-genera, *Haliphus*, *Paraliaphlus* or *Liaphlus*, but as I have not been able to determine to which of these sub-genera belong certain species such as *minor* Zimm. or *rugosus* Robts., I have not used the sub-genera in my key.

The longitudinal setigerous striole (Fig. 1a) on the internal face of the posterior tibiae of the species of *Liaphlus* sub-gen. is not always easy to see. The hind legs should be arranged far enough from the body to enable the student to have a clear view of the inner (or upper) side of the tibia as seen from above. The striole may be short or long, though never attaining the extremities of the tibia, and is situated along the middle or a little towards the inner edge. The hairs of the striole, too, may be short or long.

Contrary to what has been generally believed, both larvae and adults of *Haliphus* appear to be vegetable feeders, *Spirogyra*, *Nitella* and *Chara* being especially favoured. Mr. Matheson (op. cit., p. 182) was the first to record this interesting fact, but his conclusions have been amply confirmed by others, notably by Jennings R. Hickman in "The Annals of the Entomological Society of America, Volume XXIV,

No. 1, March 1931", pp. 132, 133. The latter author has made very valuable contributions to the knowledge of the life histories of a number of *Peltodytes* as well as of *Haliplus immaculicollis*, Harr., *H. cribrarius* Lec., *H. triopsis* Say (Papers of the Michigan Academy of Science, Arts and Letters, Vol. XI, 1929 [1930]), and in addition apparently has settled the rather vexed question of the means of respiration of these little beetles (Papers of the Michigan Academy of Science, Arts and Letters, Vol. XIII, 1930 [1931]).

According to Hickman the three species of *Peltodytes* lay their eggs on water plants such as *Elodea*, *Ceratophyllum* and filamentous algae while *Haliplus immaculicollis* Harris, the only species of *Haliplus* of which he secured eggs, laid them in holes which it cut in the stems of

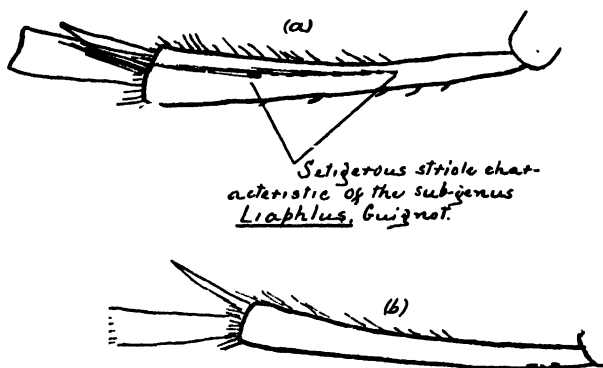


Fig. 1.—Right hind tibia, inner face of *Haliplus fasciatus*, Aubé. (b) Right hind tibia, inner face of *Haliplus* (*Paraliplus*) *pseudofasciatus*, sp. nov. (Allotype).

Ceratophyllum (Annals Entomological Socy. of America, Vol. XXIV, No. 1, March 1931, p. 136). Matheson (Jour. N. Y. Ent. Socy., Vol. XX, Sept. 1912, p. 186) records the same species as laying its eggs in the dead, hollow cells of *Nitella*.

The larval stadia are three in number (Papers of the Michigan Academy of Science, Arts and Letters, Vol. XI, 1929 [1930] and Jour. N. Y. Ent. Socy., Vol. XX, p. 187), and the insects pupate on shore in round cavities dug out at a depth of up to one inch in a suitable spot.

Since it appears certain that some, if not most or all, Haliplids are particular in their choice of food, it follows that some species at least should be local and possibly rare in occurrence, and this is true. Some species such as *H. immaculicollis* Harris can be found almost anywhere in ponds and even on the edges of slowly moving streams apparently because they have a rather wide range of food plants. On the other hand *H. borealis* Lec., while being taken by odd specimens occasionally,

is sometimes very abundant in restricted areas, no doubt because of the presence there of its special food plant.

In general Haliplids should be looked for in shallow water in which grow *Chara*, *Nitella*, or filamentous algae.

It is an interesting fact that as Hickman points out these beetles do not hibernate but remain active all winter in situations in which the water does not freeze to the bottom (Ann. Ent. Socy. Am., Vol. XXIV, No. 1, p. 134). As a converse of this *H. immaculicollis* Harr. and *H. strigatus* Robts. will aestivate, as I have frequently taken adults in summer buried an inch or so in the ground under cover of a piece of board or something similar in the dried up beds of prairie ponds. That these adults had not recently emerged from pupae was evident as they were buried loosely in the soil and not in a pupal chamber.

The species of *Haliphys* as a group do not present as difficult a study as some of the genera of *Dytiscidae* but the specimens should be clean and well mounted, and a powerful lens, or better, a binocular microscope, should be available.

It is of particular importance that specimens should be so mounted that the underside can be readily studied as the characters of the prosternum and metasternum are of special value in the separation of species.

The male genitalia consist of two lateral lobes or parameres which are remarkably dissimilar, and of a middle lobe or ædœagus which by its shape, length, width, etc., frequently affords a certain means of identification of a species. Looking backward, the paramere to the left is usually pointed and fringed with long hair on its ventral edge; the right paramere is usually considerably shorter and more or less semi-elliptical in shape, without hairs. In the figures the parameres are shown as sliced off, the left laid on its right side, and, if given, the right on its left side. The ædœagus is shown laid on its right side. Males can always be distinguished from females by the form and vestiture of the fore and middle tarsi, which in the males have the first three joints shortened and thickened, more or less produced in many species, and evidently pubescent beneath. The females have the same joints more slender and scarcely pubescent beneath.

It is with pleasure that I record my indebtedness to many good friends. Mr. Mutchler of the American Museum of Natural History really made this present study possible by sending me the duplicate Haliplid material in the Roberts' Collection, including paratypes of nearly all the Roberts' species.

Mr. Ralph Hopping of Vernon, B.C., sent me much interesting material from that Province as well as from numerous localities in the United States. To Mr. Charles Liebeck of Philadelphia, Mr. C. A.

Frost of Framingham, Massachusetts; Professor Jas. Hine of Columbus, Ohio; Mr. W. J. Brown of the Entomological Branch of the Dominion of Canada; Mr. Hugh Leech of Vancouver, B.C.; Professor C. Mickle of the University of Minnesota, I owe thanks for the loan of material.

Professor H. F. Wickham of Iowa City was generous enough to lend me the unique type of *vancouverensis*, Math., enabling me at once to establish a new species from Jasper, Alberta.

I am much indebted to Dr. F. Guignot of Avignon, France; Dr. A. Zimmermann of Munich, Germany; and to Professor Georg Ochs of Frankfurt a M., Germany, for the gift of European material and copies of some of their papers.

To Miss Cora Loton and Mr. L. H. Roberts of Winnipeg I owe thanks for assistance of another kind—the typing of manuscript.

Mr. Harold Brodie, also of Winnipeg, but now at the University of Michigan, secured for me transcripts of descriptions that otherwise might not have been available and in addition was kind enough to read the manuscript from the point of view of a student and made suggestions as to points which might prove of difficulty to a beginner.

Finally, in acknowledging assistance, may I lay a wreath on the grave of one to whom I owe much, Mr. C. H. Roberts. It was he who first really interested me in water beetles by his generosity in giving material; his keen interest in the stumbling efforts of a beginner; and above all, by his long, courteous, interesting and informative letters. It was not my good fortune to meet him in person, but I hold those nine or ten years of correspondence very dear indeed.

KEY TO THE NORTH AMERICAN SPECIES OF *Haliplus*, LATR., FOUND NORTH OF MEXICO

- Species with basal pronotal plicae.....1
- Species without basal pronotal plicae.....8
- 1. Apices of elytra strongly sinuate (Fig. 2a).....(8) *blanchardi*.
Apices of elytra not strongly sinuate, rounded or almost subtruncate
and feebly sinuate.....2
- 2. Basal pronotal plicae shorter, less than one quarter the length
measured from base of plica along the plica to the anterior margin
of the pronotum3
Basal pronotal plicae longer, more than one-quarter the length
measured from base of plica along plica to anterior margin of
pronotum4
- 3. Prosternal process rather deeply channelled longitudinally especially
over declivity. Width of head between eyes less than one-half
the total width of head (Fig. 3a). Elytral maculation usually

- distinct, consisting of six black spots in a half ellipse, enclosing a common sutural blotch. In extreme cases the maculation may almost entirely disappear.....(7) *immaculicollis*
 Prosternal process rather feebly and narrowly channelled. Width of head between eyes one half or a little more than the total width of head (Fig. 3b). Elytra without black markings of any kind. The more widely spaced punctures are a little darker than the ground colour and occasionally some of their colour extends from clusters of punctures to form indefinite brownish spots... (2) *robertsi*
4. Prosternal process evidently channelled.....5
 Prosternal process not or very feebly channelled.....6
 5. Mid-metasternum not furrowed nor longitudinally impressed at sides. ♂ protarsal claws equal.....(3) *dorsomaculatus*
 Mid-metasternum evidently longitudinally obliquely impressed at sides. ♂ protarsal claws unequal.....(4) *distinctus*
 6. Elytra with blackish uninterrupted longitudinal lines formed by the close set blackened punctures, but without spots.....(1) *strigatus*



Fig. 2.—(a) Elytral apex of *H. borealis*, Lec, showing sinuation, (b) elytral apex of *H. immaculicollis*, Harr.

- Elytra with more or less definite spots, never with blackish uninterrupted lines.....7
7. Margins of pronotum and elytra nearly or quite continuous. Base of pronotum equal to or scarcely wider than base of elytra. Side margins of pronotum narrow as usual in the genus.....(6) *longulus*
 Margins of pronotum and elytra evidently not continuous. Base of pronotum plainly wider than base of elytra. Side margins of pronotum wide for genus.....(5) *hopplingi*
 8. Prosternal ridge plainly margined at sides.....9
 Prosternal ridge not at all margined at sides or at most feebly so near apex.....28
 9. Apices of elytra strongly sinuate. Penultimate joint of labial palpi dilated inwardly into a prominent angle (Fig. 4a).....(9) *borealis*
 Apices of elytra at most feebly sinuate. Penultimate joint of labial palpi not dilated (Fig. 4b.c.).....10

10. Length 1.75 mm. to 3 mm. 11
 Length 3 mm. to 4.5 mm. 15
11. Apices of elytra evidently though finely denticulate. (10) *lewisii*
 Apices of elytra not in the least denticulate. 12
12. Length 2.7 mm. to 3 mm. Pronotum without basal transverse impression. (14) *confluentus*
 Length little if ever over 2.5 mm. Pronotum with basal transverse impression. 13
13. Pronotal basal impression deep and narrow. Elytral maculation of three distinct oblique bands. (13) *annulatus*
 Pronotal basal impression broad and flat, or feeble. Elytral maculation of pale brown blotches or shades, often feeble or obsolescent. 14

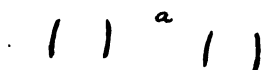


Fig. 3.—Relative width of eyes and of head between eyes of: a. *H. immaculicollis*, Harr. b. *H. robertsi*, A. Zimm. (pallidus Robts.).



Fig. 4.—Last and next to last joints of labial palpi of: (a) *H. blanchardi*, Robts. (b) *H. fasciatus*, Aubé. (c) *H. salinarius*, Wallis.

14. Head throughout quite coarsely and closely punctured, the punctures being as large or almost as large as the largest on the anterior half of the pronotum. Pronotal basal impression feeble (11) *ohioensis*
 Head throughout sparsely punctured. Pronotal basal impression broad and flat. (12) *minor*
15. Prosternal ridge but little constricted between and before front coxae, nearly or quite as wide, or wider at apex than at base. 16
 Prosternal ridge considerably constricted between and before front coxae, evidently narrower at apex than at base. 27
16. Anterior margin of pronotum not beaded at sides, frequently with a medial dark spot. 17
 Anterior margin of pronotum beaded at sides, without medial dark spot. 24

reddish yellow. Size larger usually over 3.5 mm. Widely distributed from Quebec to Minnesota and south to Louisiana.

(16) *pantherinus*

Basal black border of elytra narrow. Sutural stripe narrow, sometimes not even reaching the subsutural rows of small punctures. Colour more orange yellow. Size smaller, rarely over 3.25 mm. Texas and New Mexico.....(17) *deceplus*

23. Prosternal ridge very broad. Male protarsal claws shorter. Male ædœagus more strongly bent and with the dorsal compression a little nearer to the apex. (See Fig. 6a, b, c).....(18) *punctatus*
 Prosternal ridge somewhat less broad. Male protarsal claws longer. Male ædœagus less strongly bent and with the dorsal compression a little further from the apex. (See Fig. 6d, e, f).....(19) *mutchleri*
24. Apices of elytra distinctly denticulate. Sutural stripe narrow, not extending to the sutural striae.....(23) *connexus*
 Apices of elytra little if at all denticulate. Sutural stripe broad, extending to the sutural striae.....25

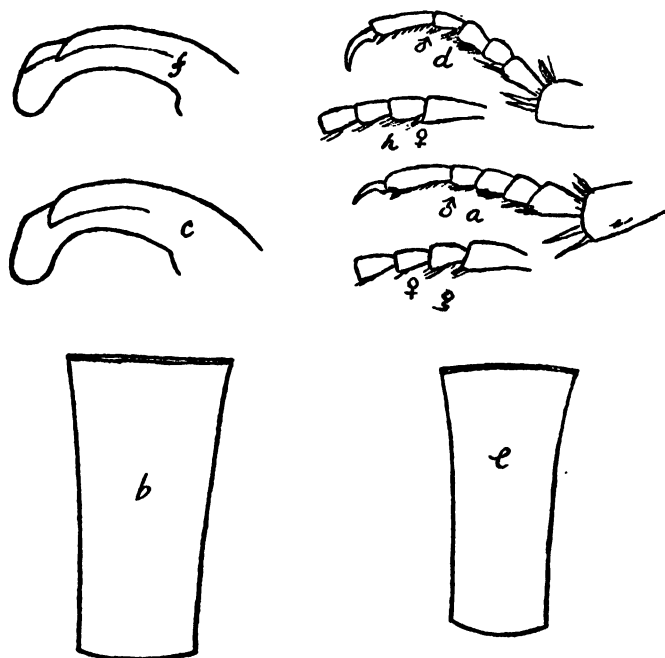


Fig. 6.—Fore tarsus, prosternal ridge, ædœagus, a, b, c, of *H. punctatus*, Aubé; d, e, f, of *H. mutchleri*, sp. nov.; g, part of middle tarsus of *H. punctatus* ♀; h, part of middle tarsus of *H. mutchleri* ♀.

25. Hind tibiae without a row of setigerous punctures on the inner (or upper) face (Fig. 1b). Prosternal ridge nearly evenly divergent from base to apex, its apex evidently wider than its base.
(21) *pseudofasciatus*
Hind tibiae with a row of setigerous punctures on the inner (or upper) face (Fig. 1a). Prosternal ridge slightly constricted between middle coxae, its apex nearly the same width as its base.
(22) *fasciatus*
26. Pronotum finely punctate. Strial punctures of first five rows confused and confluent, of remaining rows larger and quite distinctly separated. Interstrial punctures numerous, crowded and confused with those of striae. (25) *rugosus*
Pronotum strongly punctate. Elytral punctures of first five rows not confused. Interstrial punctures small and in definite rows.
(24) *mimeticus*
27. Elytra distinctly maculate with round and with longitudinal spots. (26) *apostolicus*
Elytra without maculation other than the close set blackened punctures giving a somewhat strigate appearance. . (38) *cylindricus*
28. Mid-metasternum deeply depressed behind the middle coxae. . . . 29
Mid-metasternum about on the same level behind as between the middle coxae, with a circular or subtriangular fovea at middle. . . 32
29. Subsutural rows of interstrial punctures single. Form elongate. Prosternal process very feebly or not at all margined at apex. Mid-metasternum not tumid between coxae, moderately deeply depressed behind, margined. (37) *gracilis*
Subsutural rows of interstrial punctures double. Form broader, as usual. Prosternal process evidently margined at apex. Mid-metasternum feebly to strongly tumid between coxae, not or very briefly margined. 30
30. Colour pale yellow, almost straw colour. Elytral spots small, rather indistinct. (29) *nitens*
Colour darker, reddish yellow. Elytral spots larger, distinct. . . 31
31. Average size about 4.75 mm. Punctulation of elytral striae coarse.
(27) *cribrarius*
Average size about 3.75 mm. Punctulation of elytral striae finer. (28) *canadensis*
32. Elytral punctures not in the least blackened, a little darker rufous than ground colour. (32) *vancouverensis*
Elytral punctures distinctly brownish or blackish. 33

33. Basal row of coarse pronotal punctures concolorous or almost concolorous with pronotum. 34
 Basal row of coarse pronotal punctures blackened. 35
34. Head very finely and sparsely punctate (Fig. 29d). Elytra with a feebly brownish longitudinal medial spot between first and second striae. Fore tarsal claws of ♂ equal in length. . . (35) *columbiensis*
 Head more coarsely and closely punctate (Fig. 29e). Elytra immaculate. Fore tarsal claws of ♂ not quite equal in length.
 (36) *ungularis*
35. Subsutural rows of interstrial punctures irregular and more or less double throughout, or at least with an occasional misplaced puncture throughout their entire length. 36
 Subsutural rows of interstrial punctures usually quite regular and single at least basally. 37
36. Head between the eyes one-half or a little more than one-half the total width of head including the eyes as seen from the same point (Fig. 29b). Colour reddish. Elytra usually entirely immaculate.
 (33) *salmo*
 Head between the eyes less than one-half the total width of head including the eyes as seen from the same point (Fig. 29c). Colour testaceous. Elytra moderately maculate to almost immaculate.
 (34) *leechi*
37. Head wide between the eyes, nearly twice the width of an eye seen from the same point above (Fig. 27c). Colour typically ferruginous. Subsutural rows of interstrial punctures almost regularly single and more widely spaced throughout, sometimes somewhat irregularly double apically. Elytral strial punctures rarely joined by darker colour, giving a substrigate appearance. Aedeagus of ♂ at point a little less than two-thirds the width at middle (Fig. 28d).
 (30) *subguttatus*
 Head narrower between the eyes, about $11/7$ the width of an eye seen from the same point above (Fig. 27a). Colour typically testaceous. Subsutural rows of interstrial punctures single basally, irregularly double and crowded apically. Elytral strial punctures in some parts joined by dark colour giving a substrigate appearance. Aedeagus of ♂ at point about $4/5$ the width at middle (Fig. 28b).
 (31) *salinarius*
38. Humeri of elytra asperate. (39) *tumidus*
 Humeri of elytra not in the least asperate. (40) *concolor*
- (1) **Haliplus (Haliplus) strigatus** Robts. Journ. of the N. Y. Ent. Socy., Vol. XXI, No. 2, June, 1913, p. 110.

Oval, light fulvous. Basal pronotal plica deeply impressed, rather long. Elytral apices feebly sinuate, apical angles acute. Elytral striae of fine, deep, closely placed blackened punctures, strigate. Prosternal process flat, not channelled. Mid-metasternum nearly flat, obliquely impressed behind coxae. Male pro-tarsal claws moderate in length, the anterior a little the stouter. Length 3 mm. to 3.5 mm. The left paramere, and the ædœagus are figured in Fig. 7.

Localities: Occurs from Manitoba west to British Columbia, south to Wyoming.

This species is quite common, at least in the northern part of its range, and is usually easily recognized. The only species with which it can be confused are *robertsi* and the sub-strigate forms of *immaculicollis*. The latter case will be considered under *immaculicollis*. In *strigatus* the pronotal plica is rather long, distinctly shorter in *robertsi*; in *strigatus* the elytral striae punctures are more closely set than are those in *robertsi*; in *strigatus* the prosternal process is flat, scarcely if at all channelled, while in *robertsi* it is evidently though not strongly channelled for most of its length; in *strigatus*, in the least strigate individuals, the 1st to 5th or 6th elytral striae are darkened nearly from apex to base while in the most strigate individuals of *robertsi* the darkening is confined to about the post median third of the first four striae.

In his description, Mr. Roberts made no mention of the fact that the elytra of the ♀ are strongly alutaceous, and I do not understand his statement: "intervals, including the sutural, with the punctures obsolete." This is not true of any of the many specimens I have seen including paratypes and topotypes. There appears to be always a rather close-set row of fine sub-sutural punctures often within the black sutural line, and a few, widely spaced, quite large punctures on the other intervals.

(2) **Haliplus (Haliplus) robertsi** A. Zimm. in "Die Halipliden der Welt," p. 73.

Haliplus pallidus Robts. in Jour. N. Y. Ent. Socy., Vol. XXI, June, 1913.

Oval, pale greenish yellow. Pronotal basal plica, short, rather deep. Elytral apices very feebly, if at all, sinuate, the angle about right. Elytral striae punctures small and shallow, not crowded, of a deeper shade than the ground colour, except those of the 9th and 10th striae, which are much finer, more or less confused, and not darkened. Elytra immaculate, except that in some specimens small clusters of darker punctures give an indefinite suggestion of spots. Prosternal process narrowly channelled, and with large punctures usually so confluent as to give the roughened appearance mentioned in the original description.

Mid-metasternum depressed between and behind middle coxae, especially deeply longitudinally at sides. Length 3 mm. See Fig. 8 for genitalia.

Localities: Oregon, California, Colorado, Wyoming, British Columbia.

The name *pallidus* being preoccupied by J. Sahlberg for an aberration of *H. lineatocollis* Marsh, Dr. Zimmermann proposed the name given above.

In a long series from all the localities cited there is not much variation except in colour. In that respect, however, many specimens depart from the typical greenish yellow and become much more reddish.

(3) **Haliplus (Haliplus) dorsomaculatus** A. Zimm., in "Die Halipliden der Welt," p. 75.

"Fühler einfarbig gelb, Kopf dicht und kräftig, Halsschild ebenso stark, aber besonders in der Mitte spärlich punktiert. Basalstrichel lang, scharf eingeschnitten, schräg. Punktreihen der Flügeldecken

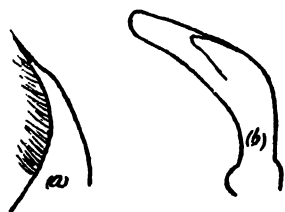


Fig. 7.—(a) Left paramere, (b) aedeagus of *H. strigatus*, Robts.

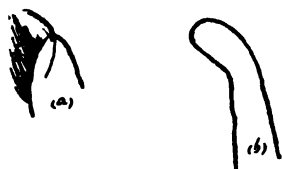


Fig. 8.—(a) Left paramere, (b) aedeagus of *H. robertsi*, A. Zimm., (*pallidus*, Robts.).

kräftig, Basalpunkte nur wenig grösser; die schwärzlichen Längslinien sind nur auf den inneren Reihen hinter der Mitte ausgebildet und verschmelzen hier zu einer grossen, gemeinsamen, aber wenig deutlichen Suturmakel. Metasternum eben, aussen grob punktiert; Prosternalfortsatz nach vorn verengt, ziemlich stark und gleichmässig punktiert, in der vorderen Hälfte mit einer flachen Längsdepression.

Männchen: Vorderklauen fast gleichlang, die innere Klaue aber an der Basis stärker gebogen als die äussere. Linke Paramere nach vorn zugespitzt, die ganze Ventralkante und die Spitze langzottig behaart. Penis verkehrt fussförmig, Dorsalkante in der Mitte bucklig emporgetrieben.

Weibchen unbekannt.

Dem *longulus* Crotch (pag. 80) am ähnlichsten, von diesem aber durch die etwas breitere, seitlich stärker gerundete, daher auch nach vorn und nach hinten mehr zugespitzte Körperform, durch das breitere Halsschild, die kräftigeren Basalstricheln, die im allgemeinen stärkere

Punktierung, durch die viel größeren Punktreihen der Decken mit etwas vergrößerten Basalpunkten, durch den punktierten und in der vorderen Hälfte flach eingedrückten Prosternalfortsatz, durch das ebene Metasternum und die wesentlichen Differenzen des männlichen Kopulationsorgans leicht zu unterscheiden."

"Nordamerika; ein einzelnes Exemplar ohne nähere Fundortangabe in meiner Sammlung."

It appears to me to be wise to reproduce these original descriptions particularly as in two cases I have not with certainty recognized the species among the abundant material at hand. Further, it is possible that the paper from which the descriptions are taken may not be readily available to American students.

The description given above follows a key which postulates the following characters for the species:

(1) Metasternum quite smooth or with a more or less deep excavation in the middle. (2) Elytra rather suddenly narrowed posteriorly (the greatest breadth at the first third of the elytral length); mostly with dark linear shading on the rows of punctures, this shading reaching from base to apex and either many times interrupted or without interruption. (3) Head reddish-yellow. (4) Elytra with a postmedian blackish sutural mark. (5) Elytra strongly laterally rounded, oval, stria punctures coarse.

From the description and from the tabular characters we may picture an insect most like *longulus*, but broader and more pointed at each end. The colour of its head is reddish-yellow and of its antennae yellow. The colour of the remainder of the insect not being mentioned we must assume that it is similar to the colour of *longulus*. The elytral punctures are coarse but only slightly larger basally, head and pronotum (except at middle) thickly and strongly punctate. The description is not clear as to the extent of the "blackish longitudinal lines" but they are fused only on the inner rows where they form an indistinct common sutural blotch. The metasternum is smooth at middle, coarsely punctate at the sides. The prosternal process is narrowed anteriorly, is fairly strongly and uniformly punctate on the anterior half and shallowly longitudinally channelled. The ♂ fore tarsal claws are equal but the inner is more strongly curved at base than the outer. Left paramere pointed anteriorly, the entire ventral edge and the apex with long shaggy hair. Aedeagus the shape of an inverted foot. Dorsal edge humped in the middle. (See Fig. 9).

It differs from *longulus* by being more oval, more pointed at each end, broader, with wider pronotum, stronger basal plica, generally stronger pronotal punctures, much coarser elytral punctures a little enlarged basally; by its prosternal process being rather strongly punctured and

longitudinally channelled anteriorly; by its smooth metasternum—in *longulus* a little depressed, smooth at middle, margined and feebly grooved within the margins. By its equal ♂ fore tarsal claws, unequal in *longulus*. If a single specimen which I have assigned to *dorsomaculatus* is correctly identified, the genitalia are entirely different. In *dorsomaculatus* the left paramere is rather short, the dorsal edge broadly arched, the ventral nearly straight and fringed with long hair; laterally, in the apical third, is an acute medial longitudinal carina, and below the carina the surface is a little concave to the hairy edge. In *longulus* the left paramere is longer, concave on the ventral, convex on the dorsal edge, rather long, narrow, and hairy only in apical third or less.

In *dorsomaculatus* the ædœagus is short, broad and rather abruptly bent at about apical third, not much narrower at the point than at the bend (Fig. 9, a, b).

In *longulus* the ædœagus is evenly arcuate below and nearly so above, almost the same shape as the left clasper, tapering gradually to a point about one-half the width of that in *dorsomaculatus* (Fig. 9, c, d).

It is most unfortunate that no exact locality is known for the type of this species. I assign to it, however, with considerable confidence, a single male specimen taken at Arcata, California, and with somewhat less certainty a female from Alamosa, Colorado, the latter in the collection of the American Museum of Natural History.

The male from Arcata agrees very well in nearly all points with Dr. Zimmermann's description, and comparison with *longulus*. It agrees in shape, maculation, pronotal and elytral punctures, basal pronotal plica more deeply engraved though a little shorter than in *longulus*, and in its prosternal process.

It does not appear to agree very well in its metasternal characters if my translation is correct. That calls for "metasternum smooth, coarsely punctate at the sides." My description of the mid-metasternum in the Arcata specimen would be as follows:—Feebly concave longitudinally at middle between the middle coxae so that there is a slight "pad" at each side, this area with only a very few scattered coarse punctures, behind the coxae a declivity so that the area behind the declivity is on a different plane from that between the coxae, the declivity punctured and the space behind it very feebly convex, smooth triangularly at middle, limited at each side by a few, coarse, elongate, oblique punctures.

This differs materially from the mid-metasternum of *longulus* in which there is no evident declivity behind the coxae and in which at each side is a feeble longitudinal punctured groove.

The genitalia of the Arcata specimen seem to agree fairly well with those described for *dorsomaculatus*. The left paramere and the ædœagus

each seem to agree except that the latter in my specimen could scarcely be said to have its dorsal edge "humped in the middle". Unfortunately it is impossible to see the exact shape of the dorsal edge as so much of the soft contents have exuded as to obscure the outline almost entirely. However, the ædæagus might be called "the shape of an inverted foot", and a glance at the figures will show the evident difference between this species and *longulus* (Fig. 9).

In the *Arcata* specimen unfortunately the fore tarsal claws have been broken off so that character cannot be checked.

If I have correctly referred this specimen, *dorsomaculatus* is exceedingly close to *robertsi*, Zimm. (*pallidus* Robts.). The genitalia are much alike (see Fig. 8, a, b, and Fig. 9, a, b), but the head of *robertsi* is a trifle smaller and a little more coarsely punctured (Fig. 10). The basal pronotal striae are longer in ?*dorsomaculatus* than in *robertsi*. My specimen of ?*dorsomaculatus* is more highly polished and has quite distinct blackish longitudinal shadings on medial half of elytra between 5th and 6th striae, between 1st and 2nd striae from just in front of middle to about apical fifth, and the 3rd and 4th striae are outlined in the same colour for about the same distance as the inner shading.

The prosternal ridge in ?*dorsomaculatus* is a little wider posteriorly, not channelled in basal half, suddenly and deeply channelled over

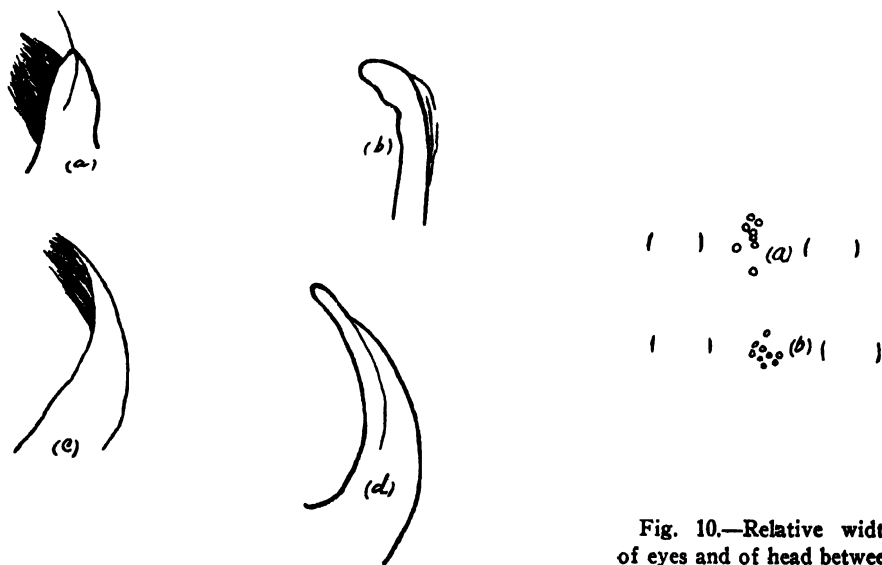


Fig. 9.—(a) Left paramere, (b) ædæagus of *Haliplus* sp. ?*dorsomaculatus*, A. Zimm. (c) Left paramere, (d) ædæagus of *H. longulus*, Lec.

Fig. 10.—Relative width of eyes and of head between eyes, and of size of punctures of (a) *H. robertsi*, A. Zimm., (b) *H. ?dorsomaculatus*, A. Zimm.

declivity. In *robertsi* the channelling commences between the front coxae. The mid-metasternal characters also differ a little. In *robertsi* the area behind the coxae is especially deeply depressed longitudinally at each side of middle. In ?*dorsomaculatus* these longitudinal foveae are not present but the area at the base of the metasternal declivity is a trifle more deeply and obliquely depressed.

(4) ***Haliplus distinctus*** sp. nov.

Holotype ♂ Length 3.1 mm. Width 1.65 mm. Shape oval, a little ovate.

Head: Reddish, conspicuously brownish between the eyes, which are widely separated. Labrum very feebly emarginate, clypeus closely and rather coarsely punctate. Punctures between the eyes considerably larger than those further forward but not as closely set. Appendages testaceous. Penultimate joint of labial palpi produced inwardly into a prominent angle.

Pronotum: Paler than head. Sparsely punctured, except the usual impunctate transverse area, with small punctures about the same size as those on head. Basal plicae long and prominent.

Elytra: Yellowish, paler than pronotum, with blackish maculation as follows: a trace of a spot antemedially between the fifth and sixth striae, a post-medial spot between fifth and seventh striae, another obliquely inward from this second spot between the second and fourth striae, this latter a little more apically placed than the corresponding spot in *immaculicollis*, a common medial sutural blotch extending to the fourth stria, and some of the strial punctures connected by their surrounding colour into lines. There is also a peculiar ivory maculation: a humeral blotch running in to the fourth stria, a small sub-humeral spot, and much of the exterior apical area with a spur running forward past the middle of the elytra between the seventh and eighth striae.

Strial punctures mostly black, usually also annulate with black or brownish-black, rather large and close inwardly, markedly decreasing in size outwardly and apically, those of the ninth row but little, those of the tenth row not blackened. Basal punctures of the 2nd, 3rd, 4th and 5th rows more or less enlarged. Interstrial punctures quite large, about one-half the diameter of those of the first strial row, those of the first row quite closely and regularly placed, of the other rows much more sparsely and rather irregularly. All elytral punctures rather deep. Apices a little sinuate before sutural angles which though rounded are acute.

Prosternum: Rather narrow, almost parallel-sided for a short distance from base, thence gently converging to summit of declivity, where the sides diverge somewhat. Margined almost from base, chan-

nelled from between the fore coxae, the side margins narrower than in *immaculicollis*. Moderately punctured, the punctures separated on the average by less than their own diameter, finely alutaceous between the punctures.

Mid-metasternum: Depressed and emarginate at base, obliquely impressed at sides behind middle coxae, the impressions with large punctures leaving a medial smooth area. Punctures between middle coxae smaller and sparse. *Ante-coxal piece* with an unusually regular row of large punctures along its anterior margin, and with a group of a few smaller ones medially behind the row, otherwise smooth. *Coxal plates* with rather small punctures, those of the basal row largest. Sutural angles rounded.

Sexual characters: Fore tarsal joints shortened and thickened. Fore tarsal claws unequal, the anterior plainly the shorter and more curved. The left paramere somewhat similar to that of *immaculicollis* but more evenly narrowed (Fig. 11a), ædæagus also of *immaculicollis* type but



Fig. 11.—(a) Left paramere, (b) Aedæagus of *Haliphus (Haliphus) distinctus*, sp. nov.

longer, with point longer, narrower and more parallel-sided, and bent to the left (Fig. 11b). Colour of left paramere and ædæagus pale yellow, the right paramere white, transparent.

Allotype ♀: Closely similar in all respects to the holotype—except of course the sexual characters, differing only by the maculation of the elytra, which is reduced to lines of punctures connected by blackish brown dashes, marking the position of the usual spots, and the presence of an excessively minute but rather dense punctulation on the elytra.

Localities: Holotype ♂ and allotype ♀ both taken by G. Stace Smith at Creston, B.C., Goat Mountain Lake, 5,000 ft., 7 VII 31. In the Canadian National Collection. Two ♂ paratypes same data of which one will be returned to the C.N.C. and the other, by the courtesy of Dr. McDunnough and Mr. W. J. Brown, will remain in mine.

This beautiful species is especially striking in its dark form and is very distinct from any of our other species. The length of the pronotal

plicae, as well as the metasternal and other characters, separate it at once from *immaculicollis* and *robertsi*. From *longulus* and *hoppingi*, in both of which the prosternal process is not channelled, the channelled prosternal process will serve to distinguish it.

Dorsomaculatus has its metasternal area not longitudinally furrowed at sides, while *distinctus* has very evident slightly oblique longitudinal lateral impressions. Further the ♂ protarsal claws of *dorsomaculatus* are equal, of *distinctus* unequal and the aedeagus is evidently different in shape.

The four specimens at hand show very little difference except in extent of maculation, the holotype being at the one extreme and the allotype at the other. An interesting variation however is seen in the size of the basal puncture of the 2nd, 3rd, 4th and 5th elytral striae. In two specimens these are markedly though irregularly enlarged.

(5) **Haliphus (Haliphus) hoppingi** sp. nov.

Holotype ♂ Length 3.2 mm. Elongate oval, a little less parallel than *longulus*.

Head: Reddish, punctured much as in *longulus* but a little more coarsely. Width between eyes a little less than one-half the total width of head (Fig. 12c). In *longulus* the width is very nearly one-half the total width (Fig. 13b). Appendages the same colour as head.

Pronotum: Coloured as head but with darker red apical and basal margins. Lateral beading wide, broadening a little behind, about twice as wide as in *longulus*; a little more than the width of the bead from being continuous with the margin of the elytra. The impunctate marginal transverse space at base wide, shining, and conspicuous. Basal striae as long as in *longulus* but considerably more deeply engraved (Figs. 12a, 13a).

Punctulation near apical margin in part coarser and deeper than that on head. Punctulation near sides and along base rather sparse, shallow, round, and moderate in size. The disc almost impunctate. Base strongly curved from suture to basal plica and reversely from plica to angle.

Elytra: Reddish, a little lighter than pronotum. Strial punctures a little coarser and more closely placed than in *longulus*, darkened; the dark colour extending from puncture to puncture to suggest a common post medial sutural blotch and a spot external to the blotch. Apices not sinuate, apical angle rounded but a little less than right.

Underside: Colour much as above. *Prosternum*: Process shaped much as in *longulus* but a little more widened at the apex; more evidently punctured especially basally and anteriorly than in *longulus*.

Mid-metasternum: Rather widely and strongly depressed between

the coxae, leaving an oblique pad on each side, the area behind the coxae nearly on the same level as this depression. Longitudinal lateral furrows behind coxae short and feeble, formed apparently by two or three coarse punctures, external margins of the furrows acute. Space between furrows a little convex, smooth and shining in a triangular area bounded by coarse sparse punctures.

Sexual characters: Anterior protarsal claw shorter and thicker than its fellow, as in *longulus*. Left clasper of genitalia almost exactly as in *longulus*; ædæagus very similar to that of *longulus* but a little wider and the point a little more abrupt (Figs. 12b, 9d).

Localities: 150 Mile House, Caribou Trail, B.C., 17 V 29, R. Hopping. In the Canadian National Collection. 1 ♀ paratype in Mr.



Fig. 12.—(a) Left side of prothorax of *Haliphus hoppingi*, sp. nov., showing wide marginal bead and basal smooth area, etc.; (b) ædæagus of *H. hoppingi*, (c) width between eyes of *H. hoppingi*.



Fig. 13.—(a) Left side of prothorax of *H. longulus*, Lec., (b) width between eyes of *H. longulus*. (For ædæagus, see Fig. 7 d.).

Hopping's collection. It is a pleasure to dedicate this species to my good friend Mr. Ralph Hopping who has helped me very much in my study of these interesting beetles.

Hoppingi is extremely close to *longulus* but consideration of the characters as given above should serve to differentiate them. The most striking characters of *hoppingi* are the coarse basal thoracic plica, the discontinuous outline, the wide thoracic lateral bead and the depressed mid-metasternum.

(6) **Haliphus (Haliphus) longulus** Lec., Lake Superior, Agassiz and Cabot, Note 31, 1852, p. 211.

Elongate oval, rather narrow, pronotal plica long, elytra highly polished, yellowish to reddish, the maculation indistinct, the most evident and persistent marking being the common sutural post medial blotch. Prosternal process not or but slightly grooved anteriorly, punctured along edges, nearly smooth at middle. Metasternum smooth at middle with a feeble longitudinal punctured furrow at each side behind the coxae. Male fore-tarsal claws unequal. Length 2.7 to 3 mm.

A widely distributed species occurring right across the continent.

(7) **Haliphus (Haliphus) immaculicollis** Harris. New England Farmer, VII, 1828, p. 164.

Haliphus americanus, Aubé.

Haliphus impressus, Kby.

Haliphus ruficollis, Crotch, Wickham, Blatchley, Matheson, Roberts, nec De Geer.

Ovate; yellow to reddish; elytra usually with the basal margin, a common sutural blotch and six spots grouped around it in a half-ellipse, black, all this maculation subject to partial or entire disappearance; striae punctures sometimes in part surrounded by dark colouring which extends to form dark lines along the striae. Prosternal process rather deeply longitudinally channelled; mid-metasternum quite strongly impressed behind the coxae; ♂ protarsal claws equal. Length 2.5 mm. to 3 mm.

Localities: Extends from east coast to west coast, far to the north and as far south as Texas.

This species for many years has been going under the name *ruficollis*, De Geer, an error illustrating very clearly the danger of assuming the identity of an American with a European species without having ample material from both regions for comparison. Credit for the restoration of the Harris name goes to Dr. A. Zimmermann of Munich, Germany, who, on page 84 of "Die Schwimmkäfer des Entom. Mus. in Berlin-Dahlem" points out the difference between the two species. Later Dr. F. Guignot of Avignon, France, on page 72 of the "Bulletin de la Société entomologique de France," 1930, No. 4, also gave the differences.

That the two species may be readily separated is evident from a comparison of North American specimens with European, a good series of *ruficollis* being in my collection, thanks to the kindness of Dr. Zimmermann and of Professor Ochs.

Immaculicollis is a stouter insect than *ruficollis* and a little more convex at the humeri. The elytral maculation is usually much better defined in *immaculicollis* than in *ruficollis*, and the inner spot, which is median in position, usually in *immaculicollis* coalesces with the sutural black margin, thus forming with its corresponding spot a dark blotch

around which the remaining six spots are grouped in a half-ellipse. Apparently this is never the case in *ruficollis*. The prosternal process in *immaculicollis* is strongly channelled anteriorly so that the process has the appearance of being margined, while in *ruficollis* the process is not or scarcely channelled the middle portion being occupied by coarse, partly confluent punctures. The mid-metasternum in *immaculicollis* is usually quite deeply depressed for almost its whole width behind the middle coxae, while in *ruficollis* it is but little if at all depressed except for a more or less pronounced medial fovea.

In *immaculicollis* ♂ the protarsal claws are equal but in *ruficollis* they are evidently unequal (Fig. 14g).



Fig. 14.—(a) Left paramere, (b) aedeagus, (c) right paramere of *H. immaculicollis* Harris; (d, e, f) same parts, (g) fore tarsal claws of *H. ruficollis*, De G.

The genitalia of the males are markedly different. The left parameres show some relationship, but in *immaculicollis* the left paramere tapers gradually to the point, while in *ruficollis* it is more parallel sided throughout most of its length, and apically converging rapidly and suddenly to the point. Also the long hairs extend rather further basally and quite to the point in *ruficollis* (Figs. 14, a, d).

The aedeagus in *immaculicollis* is rather broad throughout, the apical third almost parallel sided to the point which is only moderately and rather suddenly rounded (Fig. 14b).

In *ruficollis* the aedeagus is longer, much humped dorsally in the middle, and the sides converge from the hump so that the point is long

and at its extremity little if at all more than one-half the width of that in *immaculicollis* (Fig. 14e).

Dr. Zimmermann describes the left paramere of *immaculicollis* thus:—" . . . der linke Flügel (Taf. 1, Fig. 3) lang, stark zugespitzt, die untere Kante mit feinen, mässig langen und weisslichgrauen, die Spitze büschelförmig mit langen, borstenähnlichen, rotgoldnen Haaren besetzt." (Op. cit., p. 86).

Neither this description nor the figure on p. 85 agrees at all well with the left paramere of *immaculicollis* as I understand that species. Of course, seen from different angles these things do differ in shape but in examining dozens from all over the range of the species I have seen none which when viewed from any angle resembled Dr. Zimmermann's figure at all closely.

It is quite remarkable that such an acute observer as the late Mr. C. H. Roberts failed to differentiate these two species, but probably he did not make a really critical study of European material and was led into the error by placing too much faith in earlier workers who certainly should have known the true *ruficollis*. Mr. Crotch, in particular, was at fault when he united the two species saying, "I cannot separate American and European specimens." (Rev. of the Dytiscidae of the U.S., 1873, p. 385).

However, it is just possible that *ruficollis* does occur in North America, but in many hundreds of specimens extending in range from Labrador to British Columbia, and from Hudson's Bay to Texas, I can find nothing that could, on careful examination, be mistaken for it.

The elytral markings of *immaculicollis* are exceedingly variable. What may be considered the typically maculate form is that which has a black edging at the base of elytra from the suture to the fifth stria and a common sutural blotch with six well-defined rounded black spots grouped about it in a half-ellipse. In a series from Montreal, Canada, taken by Mr. J. I. Beaulne and kindly sent to me for study, there are represented, I think, all departures from the type of maculation mentioned above. On the one hand the black extends from the sutural blotch to first one and then another of the surrounding spots, including the black elytral tip, until they all merge into one big blotch. At the same time the black elytral edging expands until it reaches quite one-third of the distance to the sutural blotch. On the other hand the black maculation may disappear to such an extent as to leave but the feeblest of shades at the elytral base and, of the remainder of the maculation, but blackened punctures which may either form lines or else by groups indicate the positions of the usual spots or both.

The form with excessive black maculation resembles *blanchardi* to some extent but the sinuate elytral apices of the latter prevent any

possibility of confusion. The form in which the elytral spots are indicated by a few blackened punctures resembles *robertsi* Zimm. (*pallidus* Robts.) rather closely. In these cases the relative width of the head between the eyes and of the total width of the head including the eyes is useful, it being about one-half in *robertsi*, evidently less in *immaculicollis*. In those cases where the blackened punctures form lines there is a superficial resemblance to *strigatus* Robts., in which species, however, the discal striae punctures are more close set, the pronotal basal plica is longer than in *immaculicollis*, the prosternal process is not channelled and the mid-metasternum is obliquely impressed behind the coxae.

(8) **Haliphus (Haliphus) blanchardi** Robts., Jour. N.Y. Ent. Socy., Vol. XXI, June, 1913, p. 108.

Oval, shining, fulvous. Basal pronotal plica fine, moderately long. Exterior apical angle of elytra prominent; apices strongly sinuate. Elytra with base rather broadly black; a large common sutural blotch apparently formed by the coalescence, more or less complete, of three spots in the form of a triangle with its base towards the base of elytra; grouped around this a half-ellipse of six rounded spots; another rounded spot near the margin, and the apex black. Prosternal process margined, shining, and sparsely, coarsely, punctured and nearly flat between the margins except in front where it is deeply channelled over the declivity. Mid-metasternum nearly flat behind middle coxae, longitudinally impressed at each side. Length 3 mm. The genitalia of the ♂ are characteristic (Fig. 15).

Localities: Ranges from Connecticut and New York west to Minnesota and south to Louisiana.

Readily distinguished from all our other species with pronotal plicæ by its strongly sinuate elytral apices.

(9) **Haliphus (Paraliaphus) borealis** Lec., Lake Superior, Agassiz and Cabot, 1850, p. 212.

Oval, rather broad; the angle formed by the pronotal and elytral margins, seen from above, considerably more evident than in *immaculicollis*. Colour more yellow than in *immaculicollis*. No pronotal basal plicæ. Elytral apices distinctly sinuate. Elytral maculation distinct, consisting of six rounded black spots in a half ellipse as in *immaculicollis* grouped around two slightly ante-medial spots, one on each elytron between the third and fourth striae; second joint of labial palpi dilated inwardly as in *immaculicollis*. Length 2.5-3 mm. For genitalia of ♂, see Fig. 16.

Localities: The northern United States, south of the Great Lakes west to Minnesota, north to Manitoba.

This species is one of the most easily recognized. Its distinct rounded elytral maculation, pale colour, lack of pronotal plica, dilated second joints of labial palpi (as in all the preceding species) and markedly sinuate elytral apices (Figs. 2a, 4a), form a group of characters by which it can be usually distinguished in the field and unfailingly under magnification. It appears to form a connecting link between the preceding and the next group of species.

(10) **Haliplus (Paraliaphlus) lewisii** Crotch., Trans. Amer. Ent. Socy., IV, 1873, p. 384.

Moderately elongate oval, an evident angle formed by the lateral pronotal and elytral margins, seen from above. Pale yellow to feebly reddish, head a little darker at base. Punctures of head smaller than



Fig. 15.—(a) Left paramere, (b) aedeagus of *H. blanchardi*, Robts.



Fig. 16.—(a) Left paramere, (b) aedeagus of *H. borealis*, Lec.

those on pronotum, rather closely placed between the eyes. Apical margin of pronotum the same colour as the base of head. Pronotal punctures coarser than those at the base of head, those at the base of pronotum coarsest, the disk sparsely punctured. Rather broad between the eyes, the width of an eye as seen from above about three-fifths the width of the head between the eyes (Fig. 17d).

Elytral margins over the humeri, and quite strongly, towards the apices, finely, but distinctly denticulate (Fig. 17e). Elytra pale yellow to feebly reddish with more or less distinct darker maculation of very varying development. In the most distinctly marked form the maculation is dark brownish as follows: the base from the suture to the 5th stria, the entire suture to a little more than the 1st stria, this mark broadening antemedially to the second stria, forming an oblong common sutural mark which extends well toward the apex. At its apical end it

runs obliquely into the sutural stripe which again expands at apex. There are also five spots on each elytron distributed thus: one between the 3rd and 4th striae at the anterior end of the sutural oblong common spot, one diagonally forward of this between the 6th and 7th striae, a somewhat larger one just behind the middle on the 5th to 7th striae, another a little behind the one just mentioned between the 3rd and 4th striae, and the 5th nearer the apex and exterior to the 4th spot. The spot at the anterior end of the sutural oblong frequently expands to join the next two spots so that the elytra becomes really dark with irregular yellow interrupted fasciae. Usually the colour of the maculation too, is not dark brownish but pale brownish.

Strial punctures a little coarser basally. Sutural row of intermediate punctures, especially basally, nearly as coarse as those of the first stria. The remaining rows of intermediate punctures fine and very sparse.

The prosternal ridge is margined laterally and apically, feebly convex between the margins basally, feebly depressed between the



Fig. 17.—(a) Left paramere, (b) ædæagus, (c) right paramere, (d) relative width of head between eyes and of eyes, (e) apex of left elytron of *H. lewisii*, Cr.

margins apically; sparsely punctured basally, more closely apically; evidently but not strongly widened from base to apex which is not strongly declivous.

The mid-metasternum is a little depressed behind the coxae, smooth and convex medially, strongly margined and deeply furrowed within the margins; the furrows are roughly punctured.

Ante-coxal piece feebly punctured, coxal plates moderately, but rather sparsely punctured.

Left paramere of male very much like that described for the next species, *ohioensis*, sp. nov. The ædæagus evidently wider and somewhat differently shaped than in *ohioensis*. The right paramere unusually pointed (Fig. 17, a, b, c).

Length: 1.75-2.5 mm.

Localities: Type locality, Texas. Recorded by Matheson (Jour. of the N.Y. Ent. Socy., Vol. XX, Sept. 1912, p. 166) and by Zimmermann ("Die Halipliden der Welt," 1924, p. 144), also from Wisconsin and

Indiana. Mr. Roberts notes (Jour. N.Y. Ent. Soc., Vol. XXI, June 1913, p. 108) that these latter localities are interesting, "as all the specimens noted heretofore are from Texas". Dr. Zimmermann possibly or probably followed Matheson in giving his localities. I have seen no specimens from anywhere but Texas and it appears probable to me that the Wisconsin and Indiana specimens really belong to the species later described here as *ohioensis*, a reference made quite probable from the localities of the latter, Ohio and Illinois.

A discussion of this interesting species and its four close allies *ohioensis* sp. nov., *minor* Zimm., *annulatus* Robts. and *confluentus* Robts. will be given under *confluentus*.

(11) **Haliplus (Paraliaphlus) ohioensis** sp. nov.

Holotype ♀ Length 2.44 mm., width 1.24 mm. Rather evenly elongate oval, the greatest width a little in front of the middle of elytra.

Head: Reddish, a little darker than the pronotum. Rather broad between the eyes, the width of an eye being about two-thirds the width of the head between the eyes, but not quite as broad as in



Fig. 18.—(a) Left paramere, (b) aedeagus, (c) relative width of eyes and of head between eyes, (d) apex of left elytron of *Haliplus ohioensis*, sp. nov.

lewisii (Fig. 18c). Rather coarsely, irregularly, but not closely punctured, the punctures posteriorly being almost or quite as large as those on the anterior portion of the pronotum.

Pronotum: Yellowish red. Moderately coarsely punctured throughout except for two small impunctate discal spaces. Transverse basal impression feeble, evident only from the terminations of the 3rd striae.

Elytra: Yellowish red, maculate with pale brown as follows: indefinitely along about one-half of the basal margin; very indefinitely and rather narrowly along the suture to between the sixth and seventh punctures of the first stria. Here it expands laterally reaching the 4th stria; thence its external margin follows the stria for six punctures, and then runs obliquely inwards to the third stria, leaving a narrow yellowish spot before it again expands to coalesce with a spot which lies externally to the fourth stria. From this spot the margin of the sutural blotch

again runs obliquely in to the sutural stripe which continues for a short distance before expanding at the apex. There is also a sub-humeral spot and one near the margin towards the apex. The strial punctures are evidently enlarged basally, those in the basal fourth being about twice the size of those towards the apex. The sutural series of strial punctures consists of quite small, regularly, and fairly widely spaced punctures. All punctures the same colour as their ground. Elytra around humeri feebly denticulate, not the least so apically (Fig. 18d). Apices of elytra not sinuate.

Prosternum: Process margined laterally and apically, feebly convex and nearly smooth basally, evidently punctured and a little depressed between the margins apically, very gently declivous to the apical margin, moderately wide and parallel basally, widening a little in front of the procoxae. *Mid-metasternum*: Just perceptibly depressed between the coxae, visibly convex behind, smooth, strongly margined and deeply furrowed within the margins, the furrows not very evidently punctured. *Ante-coxal piece*: Sparsely and minutely punctured. *Coxal Plates*: Finely shallowly and sparsely punctured, almost smooth medially.

Allotype: ♂. Differs from the holotype only by the sexual characters and as follows:—A little smaller, 2.11 mm. in length. Colour less reddish. Common sutural blotch of elytra less regular in outline, expanding to the third stria ante-medially.

Sexual Characters: Left paramere pale straw colour, lower edge nearly straight, gently curved near apex; upper edge gently curved to the long point which is over one-third of the total length; a tuft of long pale hair on the lower edge about its middle; ædœagus rather regularly curved above and below, a little notched at a little more than apical $\frac{1}{3}$ above, the point about $\frac{3}{7}$ the width of the widest portion of the blade (Fig. 18, a, b).

Localities: Holotype. Wauseon, Ohio, IV, 1894. Allotype. Illinois, both taken by the late Professor J. S. Hine to whose generosity I owe the specimens. In addition there are ten paratypes, seven from Ohio, three from Illinois.

(12) **Haliphus (Paraliaphlus) minor** A Zimm. In Die Halipliden der Welt, p. 192.

Original description:

“Von *annulatus* durch etwas längere, in den Schultern schmalere, seitlich schwächer gerundete Körperform, durch die, besonders an der Basis, stärkere und dichtere Punktierung des Halsschildes, durch den breiteren und viel flächeren Quereindruck auf dem letzteren, durch den etwas breiteren, fast parallelseitigen Prosternalfortsatz und durch die

Zeichnung¹ der Decken verschieden. Diese beschränkt sich auf drei sehr unbestimmte, schmale Längsschatten, die auf der hinteren Hälfte der Naht und der inneren zwei Punktreihen liegen und dann auf zwei kleine Fleckchen. Von diesen steht das kleinere zwischen der 3. und 4. Punktreihe etwas vor, das grossere zwischen der 5. und 6. Punktreihe hinter der Mitte. $2\frac{1}{4}$ mm."

"Texas (Type in meiner Koll.)."

This description follows a key which postulates an insect without pronotal basal plicae, with the usual elytral punctulation, with margined prosternal ridge which is as wide as or wider at apex than at base, metasternum smooth at middle, not depressed, and with sparsely punctate head.

From the description *minor* is longer, narrower and more feebly laterally rounded than *annulatus*. The prothorax is more strongly and densely punctured and its basal impression is broader and much flatter. Its prosternal ridge is broader and almost parallel sided. Its maculation is much reduced, consisting of three very indefinite small longitudinal shadings; a common sutural one on the two inner striae behind the middle; one, the smaller, between the 3rd and 4th striae somewhat before; the other, the larger, between the 5th and 6th striae, behind the middle.

(13) **Haliplus (Paraliaphus) annulatus** Robts. In Jour. N.Y. Ent. Soc., Vol. XXI, June 1913, p. 107.

Oval, rufous, head finely, not closely punctate, width of head between eyes narrow, the width of an eye seen from above about $\frac{5}{6}$ of the width of the head between the eyes. Pronotum slightly infusate apically, rather deeply impressed basally; its punctures somewhat larger than those of head, not much sparser on disc.

Elytra scarcely visibly denticulate around humeri, not in the least so apically. Strial punctures small, a little larger basally. The punctures of the subsutural row are very small, regularly and moderately widely spaced, the punctures of the interstrial rows minute and very sparse. Maculate with three black bands: a narrow one at base, and wider ones across middle and at apex, each reaching nearly or quite from side to side.

Prosternal process margined laterally and apically, slightly convex basally, with a few scattered punctures; narrowest at base, gradually broadening apically.

Mid-metasternum margined and furrowed within the margins.

¹Zeichnung in the original. Evidently a typographical error.

Sutural angles of hind coxal plates sharp, almost produced. See Fig. 19 for ♂ genitalia.

Length 1.98-2.5 mm.

Localities: Florida and South Carolina. In addition Dr. Zimmermann (*Die Halipliden der Welt.*, p. 193) gives Texas also. I have seen specimens only from Florida.

(14) ***Haliphus (Paraliaphlus) confluentus***, Robts. Jour. N.Y. Ent. Soc., June 1913, p. 106.

Original description.

"Oval, polished, dark ferruginous.

Size: length 3 mm., width $1\frac{1}{2}$ mm.

Head evenly punctured with small, rather deep, not closely placed punctures; narrow between the eyes, which are very large and oblong oval; antennae colour of head.

Pronotum finely, evenly punctured, those of the apex being as fine



Fig. 19. — (a) Left paramere, (b) Aedeagus of *H. annulatus*, Robts.

as those of the head and closely placed, while those of the basal portion are a little coarser and not so closely placed; lightly impressed at base and with a piceous patch extending from apex to base, broadening on base; sides ferruginous.

Elytra highly polished, broadest just behind the humeri, gradually narrowing to the apices which are not strongly oblique; feebly sinuate, with the sutural angle almost rectangular; punctures of the striae much coarser than those of the pronotum, shallow, well separated, finer apically but with the rows distinct and punctures not confused; intervals, except the sutural, with very fine punctures widely separated and lightly impressed; base and suture broadly piceous and with patches of the same colour placed subhumeraly, medially, submedially, anteapically and laterally, all more or less confluent, leaving small spots only of the ferruginous ground colour showing; surface highly polished.

Under surface dark ferruginous and the punctulation, considering the size of the species, is very coarse and deep throughout.

Prosternal process with the sides parallel for nearly their entire

length, slightly wider in front and strongly margined, especially towards the apex with the apical margin evident; convex laterally with a few very fine punctures upon the convexity.

Mid-metasternum strongly margined; margins continuing in line with the prosternal ones, divergent apically, slightly thicker basally and nearly reaching the suture of antecoxal piece, with a few very fine punctures between them.

Hind coxal plates broadly rounded, slightly incurved interiorly, with the sutural angle sharp.

Abdominal segments with the usual rows of punctures deeply impressed.

Male front and middle tarsi with the joints thickened, not pedunculate.

In the female type the dark markings are not quite so much extended as in the male, more of the ground colour appearing; but the markings are equally confluent, not reduced to spots."

Localities: Taylor Co., Fla.; type locality, Sanford, Jacksonville and Tampa, Fla.

In addition to these localities given by Mr. Roberts, I have one specimen from Beaufort S.C.

I reproduce the original description as *confluentus* has been sunk as a synonym of *havaniensis*, Wehncke by C. W. Leng and A. J. Mutchler (The Insects of Florida, V. The Water Beetles, in, Bull. of the A.M. of Nat. Hist., Vol. XXXVIII, Art. III, p. 93). This reference may be correct but so far I do not think that there is sufficient evidence to warrant it. It may be presumptuous on my part, not having seen an authoritative specimen of *havaniensis*, to restore the Roberts' name but the following may be considered: Wehncke's description (Stett. Ent. Zeitg., XLI, 1880, p. 74), is:

"Breviter ovatus, rufo-ferrugineus, prothorace dense punctato, antice posticeque fusco, elytris antice griseo-submaculatis, striato-punctatis interstitiis punctis raris impressis. Long: 3mm.

Ein wenig kleiner als *H. robustus*, Shp., viel feiner punktiert und dunkler von Farbe.

Kurz eiförmig, rotbraun, Kopf fein und weitläufig punktiert; Halsschild am Vorder—und am Hinterrande bräunlich, auf der Mitte sparsam, sonst überall dicht punktiert ein wenig stärker als die Punktierung des Kopfes.

Flügeldecken hinter den Schultern verbreitert, nach hinten allmählich verengt, nicht sehr stark punktiert-gestreift. Die Zwischenräume mit einzelnen Punkten besetzt, einige unbestimmte Makeln an der Basis und auf der hinteren Hälfte der Decken dunkler, wodurch vor der Spitze einige hellere Flecken gebildet werden. Cuba."

This description with no reference to prosternal or metasternal characters, is far from satisfactory but in several particulars evidently cannot apply to *confluentus*. *Confluentus* is not "breviter ovatus" nor "prothorace dense punctate" though this is somewhat a matter of opinion; nor could we say of *confluentus* "elytris antice griseo-submaculatis."

"Head finely and diffusely punctate" does not describe very well the head of *confluentus*, nor does the description of the maculation agree with that of *confluentus*.

Dr. Zimmermann had seen neither *confluentus* nor *havaniensis* but he placed them (*Die Halipliden der Welt.*, pp. 144 and 200) in different groups based on metasternal characters, *confluentus* being with those species having the metasternum longitudinally furrowed at sides behind the coxae, and *havaniensis* being with those, e.g., *concolor*, *tumidus*, having the metasternum with deep, more or less rounded depressions. Further, Dr. Zimmermann (*loc. cit.*) says that *havaniensis* is closely related, if not identical, with *curtulus* Sharp.

There are before me at present specimens of *Haliplus* from Cuba representing six or more species but none of these is *confluentus*. Among these is a specimen from Cubanäs, P. dR. Cuba, kindly lent to me by Mr. Mutchler from the collection of the American Museum of Natural History. This specimen is labelled *Haliplus havaniensis*? and it is just possible that it was upon this that the sinking of *confluentus* was based. Whether this specimen is really *havaniensis* or not, I am not sure, but it certainly is not *confluentus* though superficially somewhat like it, its metasternal characters alone being ample to separate the two.

Taking everything into consideration it appears to me that *confluentus* should be retained as distinct, at least until the identity of *havaniensis* can be definitely established.

Of the five species just considered *confluentus* is evidently the largest and much the darkest, dark ferruginous to almost black. *Lewisii* cannot be confused with any of the others if a high enough power to show the denticulate apices of the elytra be used. *Ohioensis* is often extremely like *lewisii* in general appearance and maculation but its absolute lack of denticulation of the elytral apices and its basal pronotal impression, though feeble, will separate them. *Ohioensis* appears to be very variable in its maculation some specimens losing almost all trace of the sutural maculation and showing only an indefinite shading where the sub-marginal apical spot should be; this shading sometimes extending in a line a little way towards the base. At first I hesitated to describe this species as I feared that it might be *minor* A. Zimm.

Dr. Zimmermann, however, compares his species only with *annulatus* not at all with *lewisii*, which *ohioensis* resembles exceedingly in super-

ficial appearance. In *minor* the pronotum is more strongly and densely punctured than in *annulatus*: in *ohioensis* more strongly but not more densely. In *minor* the prosternal ridge is broader and almost parallel sided as compared with that in *annulatus*: in *ohioensis* the ridge is proportionally a little narrower throughout than in *annulatus*. Nor does the maculation as described for *minor* agree with any of the dozen specimens of *ohioensis*. Finally the locality given for *minor* is Texas and all the specimens of *ohioensis* came from Illinois and Ohio.

Annulatus differs from any of the other four by its distinctly trifasciate elytral maculation.

(15) **Haliplus (Paraliaphlus) triopsis** Say., Trans. Am. Phil. Socy., II, 1825, p. 106.

Moderately elongate oval; testaceous to light fulvous; width of head between the eyes a little less than the width of an eye as seen from the same point; head moderately, evenly punctate except as usual on the vertex.

Pronotum not beaded at the sides of the apical margin; usually distinctly impressed at base; a dark spot, usually rounded and not greater than the width between the eyes but not uncommonly transverse and longer than the width between the eyes, on the front margin; surface closely and evenly punctate especially apically where the punctures while smaller are deeper, and excepting the usual partly impunctate transverse discal area.

Elytra not very strongly punctured, the punctures of the interstrial rows not greatly smaller than those of the striae; sides and apices feebly serrulate; maculate with black as follows:—base to fifth stria expanding apically between third and fourth; suture to first stria with a medial more or less common square blotch, a post-medial irregular mark, and an apical spear head; a post-humeral spot and one obliquely inwardly from it; one near side, with a larger inwardly, both on a line with the central square blotch, and a lateral ante-apical spot; all more or less subject to confluence.

Prosternal ridge evidently though not greatly wider at apex than at base, nearly evenly divergent from base to apex though at the extreme base the sides converge slightly for a very short distance; margined at sides and apex, the side margins much roughened; feebly convex between the side margins throughout; surface moderately closely and coarsely punctured.

Mid-metasternum strongly margined, the margins nearly reaching the ante-coxal piece; feebly impressed within the margins; moderately closely punctured, the punctures a little larger than those on the prosternal convexity.

24677/56

Sexual characters—♂ fore-tarsal claws short, about or very little more than one-half the length of claw joint when measured across the curve. ♀ fore-tarsal claws also relatively short. *Ædœagus* of ♂ strongly and suddenly bent in about apical fifth (See Fig. 5 a, b, c).

Length 3 mm. to 4 mm.

Localities: From the New England States South to Carolina, Florida, and West to Minnesota, Texas and New Mexico, more common westward. It is probable that Canadian records of this species should be referred to *pantherinus* though *triopsis* may occur along the southern edge of Ontario and Quebec.

Under this name have been confused two, possibly more, species. For a discussion of this point see under the next species.

(16) ***Haliplus (Paraliaphlus) pantherinus*** Aubé, Species Gén. des Col., VI, 1838, p. 29.

Moderately elongate oval; testaceous to fulvous; width of head between the eyes a little more than the width of an eye as seen from the same point; punctulation nearly as in *triopsis*, sometimes a little finer.

Pronotum not beaded at the sides of the apical margin; impressed at base; a dark spot usually transverse and wider than the width between the eyes but sometimes rounded and narrower, on the anterior margin; punctured much as in *triopsis*, perhaps a little more coarsely and less closely apically than in that species.

Elytral punctures much as in *triopsis* but a little more shallow; sides and apices feebly serrulate; maculate as in *triopsis* but the spots usually a little larger and more confluent, and the sutural stripe frequently narrow, attaining only the rows of subsutural small punctures.

Prosternal ridge scarcely if at all wider at apex than at base, feebly constricted between the fore-coxae; margined at sides and apex.

Mid-metasternum nearly as in *triopsis*, the lateral impressions a little more pronounced.

Sexual characters—♂ and ♀ fore-tarsal claws long, evidently more than one-half the length of the claw joint, considerably longer than in *triopsis*. *Ædœagus* of ♂ considerably shorter than in *triopsis*, evenly curved below, impressed on the upper edge at about apical third, tip nearly truncate (Fig. 5 d, e, f).

Length 3.5 mm. to 4 mm.

Localities: Eastern Canada and United States to Louisiana and Minnesota.

The credit for the restoration of the Aubé name goes to Dr. Zimmermann who on pages 195 and 196 of the "Die Halipliden der Welt," points out the distinguishing characters of *triopsis* and *pantherinus*.

Strangely enough Dr. Zimmermann overlooked the striking difference in the length of the mid and fore-tarsal claws of the two species.

Of the two species *triopsis* has by far the greater range as at present recorded, but the discovery of *pantherinus* in Minnesota makes it probable that it will be found further south and west.

The characters I find most useful for separating *triopsis* and *pantherinus* are the shape of the prosternum,—sides regularly divergent to apex which is evidently wider than base, in *triopsis*; sides feebly constricted between fore-coxae, apex not or scarcely wider than base, in *pantherinus*; mid and fore-tarsal claws relatively short in *triopsis*, relatively long in *pantherinus*. If males are present the shape of the ædæagus is definitive.

It is interesting to note that almost certainly Plate XI, Figs. 11 and 12 of Matheson's work, (Op. cit.), said to represent *triopsis*, really figures *pantherinus*.

(17) **Haliplus (Paraliaphlus) deceptus** Math., Journ. N. Y. Ent. Soc., XX, Sept. 1912, p. 166.

Haliplus suturalis, Robts., Op. cit., p. 96.

Oblong oval, yellowish to yellowish-red. Pronotum with small round dark spot at anterior margin, sides of apical margin not beaded.

Elytra with base and suture narrowly dark, the sutural stripe reaching the sub-sutural row of fine punctures but not nearly attaining the first stria row, apex with usual "spear head". Each elytron with eight spots in about the usual position, the basal one coalescent with the basal dark stripe and the medial one coalescent with the sutural stripe. The apices denticulate, quite evidently around external angle, obsoletely near suture.

Prosternal ridge nearly parallel-sided, just visibly constricted between front coxae, feebly excurved apically; lateral margins strong, apical margin fine.

Mid-metasternum margined for about two-thirds of the distance to the ante-coxal piece.

Claws quite long for the size of the insect.

Ædæagus of male of *pantherinus* type (see Fig. 5g).

Length 3 mm. to 3.75 mm.

Localities: Texas—type locality of *deceptus*; Albuquerque, N.M., type locality of *suturalis*.

Extremely close to the smaller, less strongly maculate forms of *pantherinus*, but the narrow black basal elytral stripe, smaller size, usually paler colour and small rounded spots, separate it.

I do not know if the type of *deceptus* has been compared with that

of *suturalis*, but I feel sure that the synonymy as given in the Leng Catalogue is correct.

Mr. W. J. Brown of the Dominion of Canada Entomological Branch kindly compared a specimen supposed to be *deceptus* with the type of *suturalis* and reported: "Type male and female agree with your specimen in all characters as far as I can see, including *denticulation of elytral apices*. Your specimen must be conspecific." Of course, this does not necessarily mean that the specimen I had sent was *deceptus* but it agreed well with Mr. Matheson's inadequate description.

Mr. Roberts, however, in his remarks justified his description of *suturalis* by saying: (1) "The colour is not pale yellow"; (2) "the spot on the pronotum is not rufous"; (3) . . . no denticulation to the apices of the elytra"; (4) "nor is the exterior angle so acute as represented in the cut on his (Mr. Matheson's) plate of elytra"; (5) "*Suturalis* has no close relationship to either *borealis* or *lewisii*, from which species Mr. Matheson separates by comparison his *deceptus*."

I have two of Mr. Roberts' paratypes now before me and taking the above points in turn:—(1) the colour of one of these might be called pale yellow. Shades of colour are largely a matter of opinion, unless checked by the use of a standard colour chart. (2) In one paratype—from Shovel Mt., Texas,—not only the pronotal anterior spot but all the elytral marking has a distinct reddish tinge. I would not call it rufous, but it is reddish brown. In several other specimens the maculation is even more reddish. (3) As mentioned above, according to Mr. Brown, the elytral apices of the types of *suturalis* are denticulate, and this is true also of my two paratypes. (4) There is a difference in the two paratypes as to the exterior elytral apical angle. In the one from Texas it is quite as acute as represented in Mr. Matheson's plate. In the paratype from Albuquerque, N.M., it is evidently more rounded. In the remainder of the specimens seen by me the character is variable, but in none has such an acute angle been seen as in the paratype already mentioned. (5) The fact that Mr. Matheson apparently associates *deceptus* with *borealis* and *lewisii* has no weight as Mr. Matheson does not seem to have attempted to arrange his descriptions or his table in such a way as to show relationship. For instance, he places *longulus* between *connexus* and *fasciatus*, and *ruficollis* (*immaculicollis*) between his *mimeticus* and *triopsis*.

The size given by Mr. Roberts as the minimum for his species—3.25 mm.—is too great for my Texan paratype, which is almost exactly 3 mm.

(18) **Haliphus (Paraliaphlus) punctatus** Aubé., Spec. Général des Coléopt., VI, 1838, p. 32.

(Copy of translation of Aubés description given by Roberts. Op. cit., pp. 95, 96).

Length $3\frac{1}{4}$ -4. Breadth $2\frac{1}{4}$ mm.

Oval, rounded, convex, slightly depressed about the shield and ferruginous. Head quite strongly punctured, antennae and palpi testaceous.

Thorax ferruginous, with a round black spot at the middle of the front margin: one and one-half times as wide as long, strongly emarginate in front where it is narrower; sinuate at base, the sides of which are slightly oblique, the middle of the base prolonged in a point upon the elytra; sides rectilinear and oblique, front angles acute and strongly diminished, hind angles almost right angles.

Thorax covered with large, deep punctures except the centre of the disc which is smooth within a small limit.

Elytra oval, wider in front than the base of the thorax, very much dilated and then narrowing quite abruptly up to the extremity which is slightly oblique, terminating in a point. Elytra with ten rows of large, deep punctures, especially large and deep on front where the striae are confused; near the suture a line of shallow punctures close together with a few similar punctures widely separated in each interval. Elytra with six black spots quite well defined, often confluent, arranged as follows: One outside a little behind the shoulder, another a little farther inside and behind the preceding, more or less confluent with the suture; two more on the same horizontal plane about two-thirds the way down the elytra; finally back near the extremity are two others arranged slightly obliquely from the outside towards the inside and from below above, of which the internal unites with the suture. The suture is also black terminating in a large lance head; the base is also largely black for five sixths of the way from the suture.

Often all the spots, suture and base have points of contact of more or less extent.

The reflexed portion, under side of the body and feet are ferruginous.

Posterior coxal processes with large, deep punctures.

Localities: Florida, Texas and Louisiana are given by Mr. Roberts, while Dr. Zimmermann gives just "Southern States."

There is no doubt that the range of this species is considerably more extensive than has been recorded. It is evidently at least moderately abundant in the eastern half of South Carolina and occurs sparingly, possibly as stragglers, as far north as Spotswood, New Jersey. These northern specimens are usually paler, less strongly punctured, and less confluent marked than those from Florida, but I am quite unable to suggest any other placing of them.

These northern specimens can, of course, only be confused with

pantherinus in which the claws are longer and the prosternal ridge of quite a different shape, besides less obvious differences; or with *triopsis* which is always somewhat paler; nearly always with much less confluent maculation; less densely and less deeply punctured especially on the prosternal ridge, which also is less sharply margined. In addition *punctatus* has the margins of its mid-metasternum sharper and finer and less distant, and the denticulation of the elytral apices finer than in *triopsis*. The shape of the middle lobe of the genitalia in *triopsis* ♂ would settle any difficulty at once.

As was pointed out by Mr. Roberts (op. cit., p. 96), Mr. Matheson's *punctatus* is evidently not that species nor do I think that it could have been *leopardus* Robts., as that species certainly does not have its "metasternum with a narrow longitudinal groove along its median plane."

Mixed with *punctatus* I find what I can only place as a new species though it is extremely close to *punctatus*, so close indeed that Mr. Roberts years ago sent me specimens of it as *punctatus* and in the Roberts' collection are others also under that name.

So closely does it resemble *punctatus* that I describe it largely by comparison with that more common species.

(19) ***Haliplux (Paraliaphlus) mutchleri*** sp. nov.

Holotype: ♂ A little smaller than *punctatus*, 3.17 mm. long, though other specimens are as large as the smaller *punctatus*. Head and pronotum nearly as in *punctatus*, the punctulation of the pronotum a little smaller, but deeper and better separated especially on the anterior dark spot in *mutchleri*; the anterior spot smaller, less distinct, and more reddish than in *punctatus*.

Elytra in colour and maculation almost as in *punctatus*; the punctulation finer, the disparity in size of the punctures less marked apically, and the punctures of the basal halves of the ninth and tenth striae much smaller than in *punctatus*.

Prosternal ridge not as large as in *punctatus*, where it is notably large, but proportionally more widened apically, otherwise it and the mid-metasternum much as in that species (Fig. 6 b, e).

Claws (♂) of fore tarsus evidently not only proportionally but actually longer than in *punctatus*; in *mutchleri* well over two-thirds the length of the claw joint; in *punctatus* but little over one-half the length of the claw joint, the claw being measured from point to middle of the base. The joints of the fore tarsi are about as long but are narrower and less pedunculate in *mutchleri* than in *punctatus* (Fig. 6 a, d).

Ædæagus and left paramere very nearly as in *pantherinus* and *punctatus* but slightly different from either. The left paramere is a little less abruptly bent near base and the tuft of hairs on its ventral edge

is more exactly medial in *mutchleri* than in *punctatus*; the aedeagus is a little narrower throughout, especially apically than in *punctatus* (Fig. 6 f, c).

Allotype ♀.

Head anteriorly a little less densely punctate than in *punctatus*. Pronotum also less densely punctate and the medial anterior spot is dark ferruginous, smaller and more indistinct than in *punctatus*.

2nd, 3rd and 4th joints of middle tarsi less narrowed basally and therefore more cylindrical than in *punctatus* (Fig. 6 g, h). Also the first joint of the hind tarsus is not as stout as the corresponding joint in *punctatus*. Otherwise as in ♂.

Localities

Holotype: Jacksonville, Florida, in the collection of the American Museum of Natural History. Allotype, Sanford, Florida, in my collection. Seven ♂ and five ♀ paratypes, Jacksonville, Sanford, and Okeechobee City, Florida.

I must confess that I hesitated long before deciding to describe this species and indeed if it seemed possible that two forms of males of one species could occur with slightly different genitalia and fore-tarsal claws of evidently different lengths, I would not now do so. These two characters, however, seem to me to be so evidently specific that I leave it to other coleopterists to decide if I am or am not justified.

The females are very difficult to separate from *punctatus*, the less highly developed prosternal ridge, the appearance of the anterior pronotal spot, and the slight difference in the tarsal joints being of greatest assistance.

Deceptus, *pantherinus*, *punctatus* and *mutchleri* form a group which from all characters including their genitalia are very closely related. *Triopsis*, too, belongs to this group but its genitalia represents an obvious departure from the group type (Fig. 5c).

Deceptus is the smallest, palest in colour, and with a considerably reduced maculation of rounded spots. It can be told at once by its narrow black basal elytral edging and sutural stripe, though *pantherinus* not infrequently has its sutural stripe quite narrow. Its black elytral basal edging is, however, apparently always more pronounced as are its other elytral markings. It is usually larger than *deceptus*. *Triopsis* and *pantherinus* are very much alike superficially; of the same colour, size and maculation or with but scarcely definable differences in these. The shape of the prosternal ridge is usually sufficient to separate them: sides almost regularly divergent to apex, which is evidently wider than base in *triopsis*; feebly constricted between the fore-coxae, scarcely or not wider at apex than at base in *pantherinus*. In addition, the longer claws of *pantherinus* separate it not only from *triopsis* but from all other

members of the group except *deceptus*, the claws of *mutchleri*, though longer than those of *punctatus*, being shorter than those of *pantherinus*. The ædœagus of ♂ *triopsis* separates it from *pantherinus* and the remainder of its close allies.

Punctatus and *mutchleri* are usually very much darker—deep ferruginous—than the other three species but warning must be given that the specimens of *punctatus* from its more northern stations are considerably paler than those from the southern. Their punctulation is closer, deeper and coarser. Their maculation is more liable to confluence, in fact usually giving them a trifasciate appearance. Their prosternal ridge is more highly developed even than in *triopsis*, markedly broad in *punctatus*, a little less so in *mutchleri*.

In fixing the type of *mutchleri* I have taken the less common form as at present I have no means of comparing specimens with those of Aubé.

It is interesting to note that Dr. W. S. Blatchley recognized a difference between specimens of this species and typical *punctatus* as he says, "The specimens taken in Lake Okeechobee and Taylor's Creek, have the dark spot on front margin of thorax ill defined, and the black spots of elytra less confluent than in typical *punctatus* as found at Dunedin." (Insects of Florida, Va. Supplementary notes on the Water Beetles, in Bull. of the Am. Mus. of Nat. Hist., Vol. XLI, Art. IV, p. 315. New York, Sept. 27, 1919).

(20) **Haliplus (Paraliaphlus) leopardus** Robts., Jour. N.Y. Ent. Soc., Vol. XXI, June, 1913, p. 98.

Broadly oval; ochraceous; pronotum with a black spot, sometimes small and rounded, sometimes wider than the width of head between the eyes, rounded behind, on the front margin.

Elytra heavily maculate; the basal margin, the suture with a medial, post-medial and apical expansion, and six spots on each elytron, subject to confluence, all being black. Apices finely denticulate.

Prosternal process thickly margined at sides, finely at apex, sides parallel.

Mid-metasternum margined for about two-thirds its length, the anterior third much thickened and somewhat arcuate.

Middle trochanters of both sexes deeply and closely punctured on lower sides.

Claws in both sexes notably short.

The genitalia of the ♂ are distinctive. The left paramere is long and narrow, clothed on its ventral edge with golden hair. It is the most beautiful in our species (Fig. 20).

Length 4-4.25 mm.

Localities: Mass.; N.Y.; Conn.; South Carolina.

Easily told from all other known species in our fauna by its strongly punctured middle trochanters.

Dr. Zimmermann in his key to the *triopsis* group separates its component species into two sections, by the size of the pronotal dark spot. I find this character to be quite variable, fully twenty-five per cent. of my long series of *leopardus* having this spot transversely elongate, longer than the head between the eyes. In most cases, however, the spot is rounded and less than or about the same as the width between the eyes.

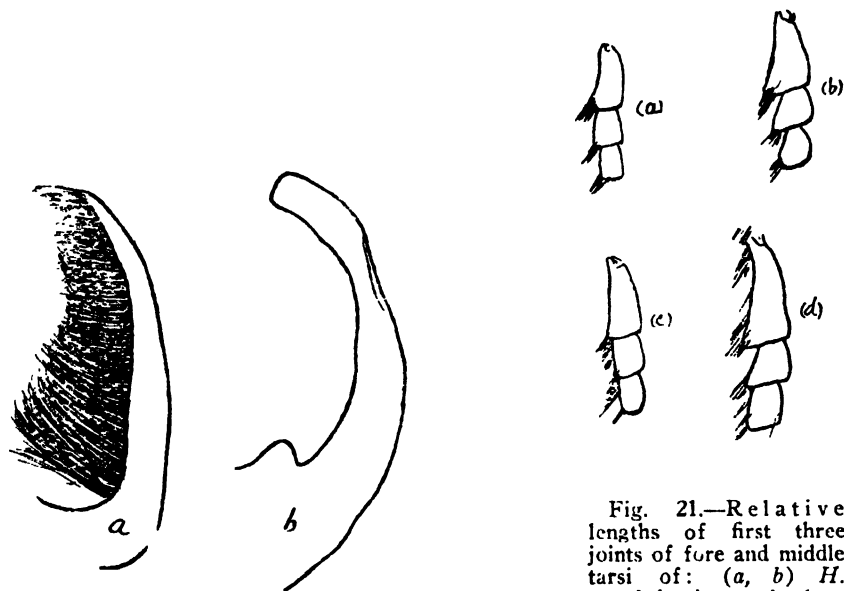


Fig. 20.—(a) Left paramere, (b) aedeagus, of *H. leopardus*, Robts.

Fig. 21.—Relative lengths of first three joints of fore and middle tarsi of: (a, b) *H. pseudofasciatus*, holotype ♂, (c, d) *H. fasciatus* ♂.

(21) **Haliphus (Paraliaphlus) pseudofasciatus** sp. nov.

Holotype: ♂ Length 3.43 mm., width 1.91 mm. Moderately broadly oval. Ferruginous above and below, elytra maculate with black.

Head: Decidedly finely and sparsely punctate anteriorly; a small impunctate area on vertex, basal punctures still fine but nearly twice the diameter of those in front.

Pronotum: Apical margin with distinct bead at sides, this bead narrower and more sharply defined than in *fasciatus*; coarsely and closely punctured throughout except for a narrow, transverse smooth area which reaches well down towards the side margins; the punctures at the extreme apex about the same size as those at base of head, larger

towards the transverse smooth space; almost all or all the punctures in the anterior half of the pronotum well rounded. Behind the transverse smooth space the punctures are larger and when seen at certain angles apparently many are transverse and more or less open behind.

Elytra: Punctulation smaller than in *fasciatus*, particularly the sub-sutural irregular rows of fine punctures and the first stria row. Maculation much as in *fasciatus* but with the medial fascia more complete by a coalescence of its component parts. Apices not denticulate.

Tibiae: Hind tibia without a longitudinal row of setigerous punctures on inner (or upper) face (Fig. 1b).

Prosternum: Ridge broad, margined at sides and across apex, the latter margin being stronger than is the case in *fasciatus*, the lateral margins much roughened and punctured; evidently convex between the margins, moderately coarsely and closely punctured; the sides diverging almost evenly from base to apex, scarcely visibly constricted between the middle coxae, the apex evidently wider than the base. *Mid-metasternum* quite strongly margined, the margins long, nearly reaching the suture of the ante-coxal piece; evidently depressed at each side just behind the middle coxae, the depressions longer than in *fasciatus*, nearly attaining the posterior ends of the margins; sparsely and finely punctured. *Ante-coxal piece* more closely punctured than in *fasciatus*.

Sexual characters: Middle and fore tarsal joints a little dilated and elongate, the first joint of front tarsi a trifle shorter than, the first joint of middle tarsi about as long as, the next two joints combined (Fig. 21). Protarsal claws rather short, not modified. *Ædœagus* and left paramere very much like those in *fasciatus*, but smaller and the *ædœagus* of a little different shape (Fig. 22).

Allotype: ♀. As in the holotype, but with the maculation less coalescent.

Localities: Holotype, Beaufort, S.C., in the collection of the American Museum of Natural History. Allotype, Beaufort, S.C., in my collection through the courtesy of the authorities of the American Museum of Natural History. Two ♀ paratypes, Beaufort, S.C., will be returned to the American Museum of Natural History and a ♂ paratype Beaufort, S.C., will be retained in mine. Two ♀ specimens from Galena, Kan., I also assign here with considerable certainty.

Three ♂ and one ♀ specimens were taken by Mr. O. L. Cartwright of Clemson College, South Carolina, at Switzerland, South Carolina, on November 1, 1931. These have been marked paratypes, two of which will be returned to the collection of the Clemson Agricultural College, one will be deposited in the Canadian National Museum, and one will remain in my collection.

It is of particular interest to note that these specimens from Switzerland were taken in company with *fasciatus*.

(22) **Haliphus (Liaphlus) fasciatus**, Aubé., Spec. Gén. des Col., VI, 1829, p. 29.

Length: 4 mm. to 4.5 mm.

Moderately broadly oval. Pale yellow to pale rufous. Head rather sparsely and finely punctate, the usual almost impunctate space on vertex, the punctures at base of head closer and a little, but not much, larger than those on front of head.

Pronotum margined along apex at sides; closely and rather coarsely punctured throughout except over a narrow transverse discal area which is smooth. Punctures nearest the apex smallest, about the same size as those at base of head. Punctures posterior to the transverse smooth area but little larger than those in front of it. The punctures are close to, but rarely touching each other and are nearly all round.

Elytra broadly and irregularly black across most of base; a large black posthumeral spot extending laterally from the fifth to ninth stria; a little obliquely and interiorly from the post-humeral spot is a quadrangular spot between second and third striae, this spot giving off two spurs, one running in to join the sutural stripe, the other to an elongate spot between the fifth and sixth striae; externally of this latter spot is a submarginal rounded spot extending from the seventh stria almost to the margin; behind these a more or less broken black fascia often practically entire except for a narrow space between fourth and fifth striae; suture black to first stria; apex black. Apices not denticulate.

Prosternal ridge broad, margined at sides and across apex, the lateral margins much roughened, a little convex between the margins, moderately coarsely but not closely punctate. Feebly constricted from base to between the fore-coxae, thence more rapidly divergent to the apex, which is very nearly the same width as the base.

Mid-metasternum quite strongly margined, the margins long, reaching or nearly reaching to the suture of the ante-coxal piece; a little depressed at each side just behind the coxae; finely punctured, a little more coarsely and sparsely at middle, very sparsely behind.

Hind tibiae with a row of setigerous punctures on the inner (or upper) face (Fig. 1a).

Edæagus rufous, darker, especially basally, along the lower edge; about regular in width to apical fourth whence the upper edge rather suddenly angles to a moderately narrow point. Left paramere yellowish, with long hairs on lower edge in about middle half, and short hairs to the point. (See Fig. 22 c, d).

Middle and fore tarsal joints of male strongly thickened and lengthened, the first joint of the front and particularly the first joint of middle tarsi elongate, longer than second and third joints combined. (See Fig. 21).

Localities: Ranges from the North Eastern United States, south to the southern extremity of South Carolina (Switzerland), and westward to Kansas.

(23) **Haliplus (Liaphlus) connexus** Math., In Journ. N.Y. Ent. Socy., Vol. XX, Sept. 1912, p. 164.

Much the same general appearance as *fasciatus* but usually a little paler and a little smaller. The elytral spots and margins usually smaller but more connected than in *fasciatus*; the sutural black stripe does not reach the first stria as in *fasciatus* by which character also *connexus* separates from *pseudofasciatus*. Prosternal ridge almost exactly as in *fasciatus*. Mid-metasternum with its sides more widely curved between coxae, the lateral impressions a little more pronounced and longer, the side margins not reaching quite so far posteriorly, as in *fasciatus*. Basal joints of pro- and meso-tarsi much as in *fasciatus*, therefore thicker and longer than in *pseudofasciatus*. Apices of the elytra evidently, usually strongly, denticulate. For tarsal joints and genitalia see Fig. 23.

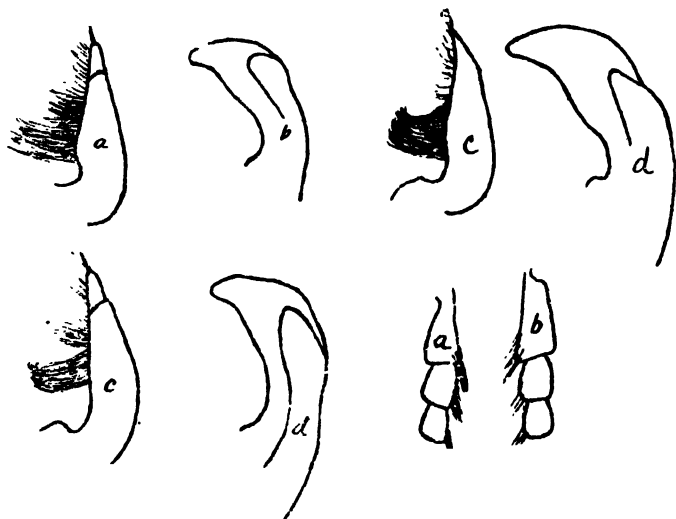


Fig. 22.—(a) Left paramere, (b) Aedeagus of *H. (Paraliaphlus) pseudofasciatus*, Sp. nov., (c) Left paramere, (d) aedeagus of *H. (Liaphlus) fasciatus*, Aubé.

Fig. 23.—First three joints of (a) fore, (b) middle tarsus, (c) left paramere, (d) aedeagus of *H. connexus*, Math.

Localities: Nova Scotia to Eastern Ontario; Massachusetts to Minnesota.

The three species *fasciatus*, *connexus* and *pseudofasciatus* resemble each other in shape, colour and maculation very closely. *Connexus* can be at once separated by its evidently denticulate elytral apices. *Pseudofasciatus* has a slightly differently shaped prosternal ridge from either of the others, does not possess hind tibiae with a row of setigerous punctures on the inner (or upper) face, and its males have shorter basal joints on their middle and fore tarsi.

(24) **Haliplus** (sub. gen.) **mimeticus** Math., Jour. N.Y. Ent. Socy., Vol. XX, Sept. 1912, p. 168.

Original Description.

"General colour rufous. Length 3.5 mm.

Head densely and strongly punctate except a small area on vertex; labrum emarginate, rounded at the sides. Pronotum densely and strongly punctate, not so strongly on the disc; a semicircular depression across the disc, the hind margin convex posteriorly. Prosternal ridge strongly margined, densely punctate, convex longitudinally and laterally, the anterior margin squarely truncate and sharply declivous. Abdominal segments shining, sparsely punctate. Posterior coxae punctate, attaining the fourth segment of the abdomen.

Elytra each with ten rows of large shallow punctures, intervals each with a definite row of small punctures; apices of elytra obliquely truncate."

Localities: "Pacific Coast," according to Matheson. Dr. A. Zimmermann (Die Halipliden der Welt., p. 197) gives Mexico only.

Mr. Matheson's description is entirely inadequate, but I am unable to add to it as I have not seen the type nor recognized the species among the extensive material I have studied from the west coast.

Dr. Zimmermann (loc. cit.) adds considerably to the description given above, but had seen only the female as was true also of Mr. Matheson.

Mr. Roberts' suggestion that *mimeticus* is *concolor* I do not think to be probable. While the description might serve as far as it goes, for ~~concolor~~, it is scarcely conceivable that Mr. Matheson would not mention the metasternal characters.

(25) **Haliplus** (sub. gen.) **rugosus** Robts., Jour. N.Y. Ent. Soc., XXI, June 1913, p. 102.

Original Description.

Broadly oval, widest at middle, not strongly convex, rufous.

Size: length 4 mm., width 2½ mm.

Head finely, evenly not deeply punctate except a small space at vertex impunctate; eyes large, round, well separated, rather prominent; antennae rufous.

Pronotum finely, evenly, densely punctate; distinctly impressed at base before the scutellum; a narrow median line at apex infusate.

Elytra uniformly rufous, except a small central patch of testaceous extending from the sixth stria to lateral margin; broad, nearly flat dorsally, with the sides gradually rounded and with the lateral margins serrulate to the exterior apical angle; apices oblique and feebly sinuate with the sutural angles obtuse; stria punctures moderately large and deep, those of the sixth to tenth being largest and quite distinctly separated while those of the first five are confused and confluent giving the whole basal area between the humeri, and extending fully one-quarter of the distance to apices, a decidedly rugose appearance; punctures strongly diminished apically; fine punctures of the dorsal interspaces numerous, crowded and mixed up with those of the striae.

Under surface nearly unicolorous with the upper.

Prosternum with the sides slightly constricted from base to front coxae and thence strongly excurved to apex, which is one-third wider than base; sides with heavy, thick margins, apex less thickly margined; slightly convex laterally, strongly arched apically and closely, finely, deeply punctured between the margins.

Mid-metasternum with thickened margins continuing in alignment with those of the prosternum and reaching the suture of ante-coxal piece; interspace nearly flat and finely punctured.

Hind coxal plates with moderately fine, evenly placed, deep punctures; apices broadly, separately rounded.

Abdominal segments distinctly margined posteriorly and with the usual rows of punctures very fine, almost obsolete.

Male front and middle tarsi thickened and slightly pedunculate.

Locality: California.

I have not seen this species.

Dr. Zimmermann, (*Die Halipiden der Welt.*, p. 197), suggests the possibility of *rugosus* being the same as *mimeticus*. This appears to me to be very improbable, the characters given in the very careful description of *rugosus* seem to be entirely at variance with those given by Mr. Matheson for his species.

(26) **Haliphus (Liaphlus) apostolicus** sp. nov.

Holotype: ♂ Oval, convex, much as in *cribrarius*. Length 4.09 mm., width 2.18 mm. Reddish yellow, maculate with black or brownish black.

Head: Rather wide between eyes, its narrowest width being about 13:9, the latter proportion being the width of an eye as seen from above;

moderately and evenly punctured, the punctures being separated by distances varying from a little more to a little less than their own diameter; base a little more coarsely punctured, a narrow impunctate space between hind margin of eyes. Base with a brownish black medial mark' concealed by pronotum.

Pronotum: Somewhat irregularly and not very closely punctured, a more or less impunctate transverse medial space; punctures at apex somewhat larger even than those on the base of the head, punctures larger basally; a row of blackened punctures, irregularly double inwardly, along base; a brownish-black transverse spot, about the width of head between eyes, on anterior margin. Posterior angles sharp; pronotal base evidently a little wider than elytral base.

Elytra: Oval, widest a little before middle, apices feebly oblique, just sinuate before the inner angles so that these are very slightly produced and, though rounded, sub-acute. Striae of well separated deep blackened punctures mostly somewhat smaller in size apically. All interspaces with well developed rows of small deep punctures, blackened except on the tenth interspace, the sutural row irregularly double. Surface exceedingly finely and quite densely micro-punctulate so that the surface is somewhat dulled.

Maculate as follows: Suture black from base to apex to about the row of small punctures between the suture and the first stria, base black from suture to half way between the fifth and sixth striae, the black extending slightly apically on second stria, to the second puncture on third stria, to third puncture of fourth stria and in a triangular patch externally of the fifth stria; a sub-humeral blotch extending from the fifth to the eighth stria; one obliquely below this between the second and fourth striae, its inner edge being continued apically by a long stem on and within the second stria, the end of the stem expanding to fill the interspace and connecting with the sutural stripe by a narrow expansion. Four spots externally of the expansion of the stem, between the third and fourth, fifth and sixth, seventh and eighth, ninth and tenth, striae, the second being the largest, two longitudinal spots below these between the second and third and fourth and fifth striae and obliquely below and externally of these a blotch between the seventh and tenth striae; apex black to exterior angle.

Prosternal process margined laterally and apically, the lateral margins roughened; rather coarsely punctured, almost flat, feebly depressed along margins basally, the depressions markedly confluent punctured; constricted between fore coxae, apex about three-quarters the width of the base.

Mid-melasternum slightly tumid between, deeply depressed behind

middle coxae, distinctly and acutely margined nearly halfway to ante-coxal piece, its exterior edge between the coxae thickened into pads.

Coxal plates coarsely and moderately closely punctured, apices broadly rounded, the inner angles slightly obtuse.

Anal segment rather closely and moderately coarsely punctured in apical half.

Legs: Concolorous with body, extreme base of femora and trochanters redder. Fore-tarsal claws short, rather abruptly bent, the anterior slightly the more so.

Genitalia: Pale testaceous, left paramere with the usual tuft of concolorous hairs; ædæagus evenly curved. Almost the same width throughout, just a little narrower, (seen from side), in about apical fourth which is almost parallel-sided with a rounded end (Fig. 24).

Allotype: ♀. Differs from the Holotype only in a little more pronounced maculation with a tendency to coalescence. Thus the four external sub-median spots are joined as are the two inner ante-apical. The coxal plates are a little less coarsely and closely punctured.

Holotype and Allotype: St. Paul, Bussey's Pond, Minnesota. 29, VI, 1921, W. E. Hoffmann, the Holotype in collection of the University of Minnesota, the Allotype in mine.

A ♀ paratype will be deposited in the collection of the University of Minnesota, another in the A.M.N.H., a ♂ paratype in the Canadian

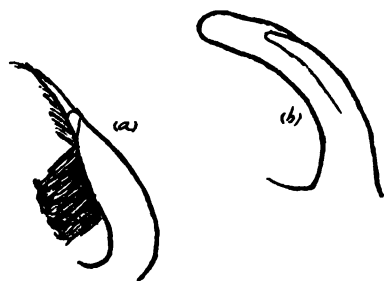


Fig. 24.—(a) Left paramere, (b) ædæagus of *Haliplus apostolicus*, sp. nov.



Fig. 25.—(a) Left paramere, (b) ædæagus of *Haliplus cribrarius*, Lec.

National Collection and one in mine. The data for the paratypes is the same as for the type except that one comes from Itasca State Park, Green Lake, August 21, 1922.

This interesting species is both in facies and maculation extremely like *cribrarius* Lec. It is somewhat smaller, and is very evidently different when the under-body is examined. The elytra of *cribrarius* are also micro-punctulate, but much less evidently than in *apostolicus*. The prosternal process in *apostolicus* is evidently though not very strongly margined throughout, while in *cribrarius* there is no trace of margins except over the declivity and at the apex, though occasionally the sides of the prosternum become discoloured giving somewhat the appearance of a margin.

The characters of the mid-metasternum are even more strikingly different. In *cribrarius*, the mid-metasternum is decidedly tumid and absolutely devoid of margin between the coxae and but rarely very briefly and obscurely margined behind. The deep depression behind the coxae seems as much the result of the swelling between the coxae as of an actual lowering of the surface behind. In *apostolicus* the mid-metasternum is little if at all tumid, with usually rather wide pad-like margins between which is a slightly depressed area. Behind the coxae the metasternum is deeply depressed, usually with an especially deep circular area in the middle, acutely and strongly margined well towards the ante-coxal piece.

From the species of the *triopsis* group—margined prosternal process and black spot on apical margin of thorax—it can be separated immediately by the elytral maculation which in *apostolicus* tends to be fractilinear in appearance, increase in size of the spots taking place more by lengthening than by widening, while in all the others known the spots incline to widen more than to lengthen. In addition, the species of the *triopsis* group belong to the subgenus *Paraliaphlus*.

It is quite remarkable that so few of this species have been taken, for the type station—Bussey's Pond—a pond on the campus of the University of Minnesota, must have been well worked. Probably a close examination of specimens labelled *cribrarius*, *niens* or *subguttatus* would reveal some *apostolicus*.

(27) **Haliplus** (**Liaphlus**) **cribrarius** Lec., Lake Superior, Agassiz and Cabot, 1850, p. 202.

Rather pale reddish yellow. Oval.

Head rather narrow between eyes, the width of an eye seen from the same point above greater than half the width of the head between the eyes. Regularly and finely punctate before the transverse smooth area,

less regularly and a little more coarsely behind it; a dark spot at base of head.

Pronotum broadly sparsely punctate in medial transverse area, finely closely anteriorly; two more or less irregular rows of blackened punctures, the anterior the shorter, across base, the posterior of these sometimes quite regular and the punctures much enlarged; a dark spot on anterior margin.

Elytral strial punctures large, not greatly smaller apically or basally, subsutural rows of interstrial punctures irregularly double, the other

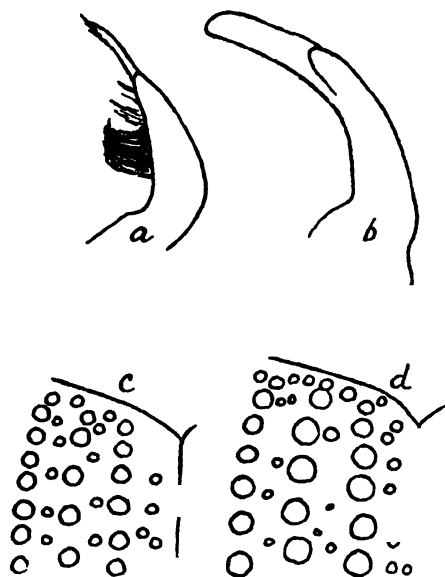


Fig. 26.—(a) Left paramere, (b) aedeagus of *Haliplus* (*Liaphlus*) *canadensis*, sp. nov. Comparative size of elytral punctures in baso-sutural region of: (c) *H. canadensis*, sp. nov., (d) *H. cribrarius*, Lec.

interstrial rows single, the discal rows closer than usual. Suture black to row of fine punctures; base black except above humeri, the black expanding posteriorly; post-humeral spots between the 5th and 6th and on the 7th striae; an irregular spot on the 2nd, 3rd and 4th striae connected by an oblique stem to the sutural stripe near the middle of the elytra; three spots set slightly obliquely externally to where the stem joins the sutural stripe; four in a transverse row nearer the apex; and the usual spear head at the apex, blackish. Apices almost exactly obliquely truncate from external to apical angle.

Prosternal ridge flat, not margined at sides except over declivity,

margined at apex; rather suddenly and strongly constricted just in front of fore-coxae; quite strongly and closely punctate; not quite as broad at apex as at base.

Metasternum tumid between the coxae, deeply depressed behind, the middle of the depression usually being fovea-like.

Hind coxal plates with apices feebly sinuate, the angle evident but just obtuse.

Anterior row of punctures on the ante-coxal piece usually very regular, the posterior row much interrupted.

Fore-tarsal claws of male short, less than one-half the length of the claw joint.

Genitalia: Point of left paramere long; ædæagus of even width to apical fifth, the dorsal edge thence slightly converging towards ventral, curved at point (Fig. 25).

Length: 4.5 mm. to 5 mm.

Localities: Labrador to Vermont, westward to Manitoba and Minnesota.

(28) ***Haliplus (Liaphlus) canadensis***, sp. nov.

Holotype: ♂ Length 3.75 mm. Width 1.98 mm. Oval. Rather pale reddish yellow, as in *cribrarius*, maculate with black or dark brown much as in that species.

Head: Moderately wide between the eyes, proportionally a little wider than in *cribrarius*; regularly, closely, and moderately coarsely punctured in front of the smooth transverse area; less regularly but a little more coarsely punctured behind; base with a dark brown spot.

Pronotum: Rather closely, regularly, and moderately coarsely punctured except on the disc which is less regularly punctured; the basal punctures somewhat enlarged and darkened, the row at the extreme base largest in size; an anterior medial dark brown spot present; feebly depressed at base.

Elytra: Strial punctures throughout larger than in *nitens*, smaller than in *cribrarius* (Fig. 26 c, d); subsutural rows of punctures irregularly double, other interstrial rows single, though somewhat irregular between the first and second striae, rather closely spaced. Maculation as follows: Suture darkened to subsutural row of punctures, base feebly browned medially at each side; posthumeral spots between the 5th and 6th, and on the 7th striae; an irregular spot between the 3rd and 4th striae connected by a projection to a stem which runs apically along the 2nd stria until it expands near the middle to form a small spot between the 1st and 2nd striae, but not joining the sutural stripe; three spots and the suggestion of a fourth in a transverse row externally to the expansion; three in a transverse row nearer the apex; and an apical spear-head, all

black with a brownish tinge. A little in front of the external apical angle the margin of the elytra curves rather sharply downward and the sides of the elytra are a little, though quite evidently, impressed, giving the insect the appearance of having been pinched. Apices just sinuate.

Prosternum: Just visibly convex, not margined at sides except very shortly near the apex, margined as usual at the apex; moderately constricted between the coxae; strongly, closely and somewhat rugosely punctured; not as broad at apex as at base.

Metasternum: Somewhat tumid between the coxae just perceptibly convex at middle, depressed but not very deeply so behind, broadly angularly excavated; punctures between coxae smaller than those on the prosternum, larger behind but leaving a triangular smooth area. *Ante-coxal piece*: With a rather regular anterior row of large punctures and an irregular interrupted row of much smaller ones behind. *Coxal plates*: Moderately coarsely punctured, the disparity in size between those of the anterior row and the remainder much less marked than in *nitens*.

Sexual characters: Genitalia paler than in *cribrarius*, the aedeagus proportionately more slender than in that species and narrower in apical fourth (Fig. 25, 26).

Allotype: ♀, Differs from the holotype in no essential respects except that the maculation is a trifle reduced; the prosternal process a little narrower basally, a trifle flatter and less coarsely punctured; and the mid-metasternum behind seems to be very finely and briefly margined, an appearance given, however, by the arrangement of the lateral punctures.

Localities: Holotype, Winnipeg Beach, Manitoba, 6 IX 1909. Allotype, Husavick, Manitoba, 17 VII 1916, taken by myself and both in my collection. There are before me numerous ♂ and ♀ paratypes extending in range from Vermont and Massachusetts, U.S.A., to Ottawa and Glen Major, Ontario, and Peachland, British Columbia. Paratypes will be placed in the Canadian National Collection, the U.S.N.M., the A.M.N.H., and M.C.Z., University of Minnesota, British Museum and in various private collections.

The three species of the subgenus *Liaphlus*, distinguished from their allies by the deep depression of the mid-metasternum and their laterally unmargined, or almost unmargined prosternal ridge, are readily separated though, strangely enough, there has long been confusion. Dr. Banks of the M.C.Z. kindly compared specimens with the Leconte types and thus gave me invaluable help.

Nitens is typically very pale, the punctulation of the elytra unusually small and the elytral maculation reduced to a few small spots. It is about 3.75 mm. long. It has a feeble transverse thoracic discal impression but I am doubtful as to the usefulness of this character.

For many years I have been puzzled over *cribrarius* as, according to the determinations of Mr. Roberts, there was a large coarsely punctured form and a smaller more finely punctured form. In colour and in maculation, prosternal and metasternal characters these two forms are much alike, and I was inclined to consider the smaller as *nitens* until Dr. Banks made comparisons for me. His comments seemed to settle the matter but in addition there was Mr. Roberts' opinion to be taken into consideration. Mr. Roberts' conception of *nitens* agrees perfectly with the type according to Dr. Banks, but Mr. Roberts confused the smaller form mentioned above, not with *nitens* but with *cribrarius*. I have several of this form so indentified by him, and indeed the specimen chosen as the holotype still has Mr. Roberts' *cribrarius* label on it. Further in the Roberts material from the A.M.N.H. there were numerous mounted specimens of the small form mixed with *cribrarius* and the two forms were almost indiscriminately mixed when glued on to cards, though there was apparently some attempt to segregate by size.

Cribrarius, Lec., is rarely, if ever, less than 4.5 mm. in length, the average being quite 4.75 mm., my new species *canadensis*, is rarely over 3.75 mm. in length. *Cribrarius* has large elytral stria punctures; those of *canadensis* are much smaller though not always as small as those of *nitens*. The peculiar lateral elytral impressions are sometimes very feebly present in *cribrarius* and *nitens*, but in *canadensis* they are much more evident so that usually specimens of that species can be determined by this alone. The two spots at the apical ends of the stems on the 2nd striae rarely coalesce at the suture in *canadensis*, while in *cribrarius* they usually form a quite conspicuous common sutural blotch. Finally the aedæagus forms a certain means of separating males of *cribrarius* and *canadensis*. Unfortunately I have been unable to dissect a male of *nitens*.

Canadensis shows remarkably little variation in size, but its maculation may be reduced to smaller spots, always however much darker and more pronounced than in typical *nitens*, or increased by lengthening or widening. The basal thoracic depression of *canadensis* is usually, though not always, evident.

(29) ***Haliplus* (*Liaphlus*) *nitens* Lec.**, Lake Superior, Agassiz and Cabot, 1850, p. 212.

Colour pale yellow, almost straw colour.

Head wide between eyes, evenly finely punctured anteriorly, a little more coarsely behind transverse smooth area; base with a small brownish spot.

Pronotum moderately strongly and quite closely punctured over anterior half; the punctures behind the smooth transverse area larger

but not greatly so, a small brownish spot on anterior margin; the posterior punctures in part browned; the anterior margin medially broadly angulate; disc with a transverse depression.

Elytra with unusually small strial punctures not greatly decreased apically or laterally, interstrial punctures moderate; suture narrowly darkened, a variable number of small spots present or hinted at on each elytron, the maximum being about ten or eleven; punctures, except those of tenth row, darkened; apices a little sinuate; apical angles about right.

Prosternal process constricted between coxae, a little narrower at apex than base; flat to feebly convex, rather coarsely and closely punctate; margined apically but not laterally, except sometimes feebly and very briefly at extreme apex.

Mid-metasternum not margined, a little tumid though the tumidity occasionally is very feebly concave between coxae, somewhat depressed and with a large deep medial fovea behind; finely and closely punctate in front, more grossly at sides behind, smooth behind fovea.

Ante-coxal piece closely and rather coarsely punctured. Hind coxal plates rather closely but not grossly punctured.

Length 3.75 mm.

Localities: Michigan, Wisconsin, and south to Texas.

(30) **Haliphus (Liaphlus) subguttatus** Robts., Jour. N.Y. Ent. Soc., XXI, June 1912, p. 101.

Oval, convex, ferruginous. Length 3.75 mm. to 4.25 mm. Head wide between the eyes, very nearly twice the width of an eye as seen from the same point above (see Fig. 27c); finely, evenly, closely punctate, the usual transverse area impunctate; a narrow blackish or infusate space, sometimes obsolete, at base of head.

Pronotum finely and unevenly punctured anteriorly; a discal transverse area impunctate, an irregularly double row of blackened, deep punctures, not very much enlarged, except laterally, at base; anterior margin slightly prominent but scarcely angulate at middle. Apical margin with or without an infusate area.

Elytra oval, striae of deep blackened punctures, not notably large, decreasing somewhat in size apically and nearing the margin; sutural row of small punctures almost perfectly single, at least basally, small and evenly spaced; base immaculate, suture narrowly black; maculation described by Mr. Roberts as follows: "Maculate with elongate spots or dashes of black, one nearly touching the base between the third and fourth striae, one subhumeral between the fifth and sixth, one obliquely below this between the third and fourth, three below this last placed horizontally, the inner extending in a patch from suture to second

stria, the middle between the fifth and sixth and the outer between the seventh and eighth, below these four more subapical, between the second and third, fourth and fifth, sixth and seventh, this last very short, and a patch from eighth to lateral margin."

Prosternal ridge just visibly convex, constricted before front coxae where it is about three-fifths the width of the base; apex almost exactly the same width as base; sides not margined, apex evidently and acutely, though not very strongly so; closely deeply and moderately punctured.

Mid-metasternum just perceptibly convex from side to side, but not tumid and without sign of "pads" at the sides between the coxae; not margined, smooth or with a small fovea at middle; punctulation a little finer than on the prosternal process.

Genitalia of ♂ ferruginous; point of left paramere only moderately long; ædæagus narrowed towards point which is not quite two-thirds the width of the ædæagus at middle (Fig. 28).

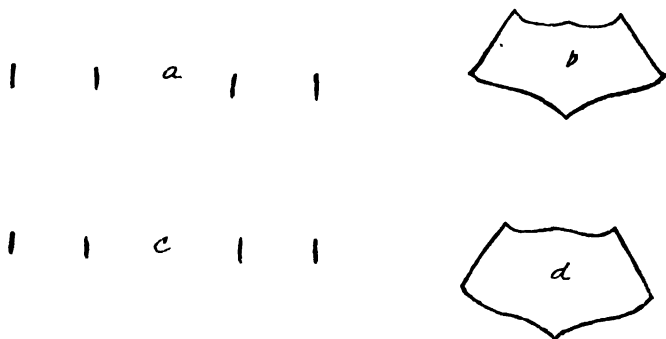


Fig. 27.—(a) Relative width of eye and of head between eyes of *H. salinarius*, sp. nov., (b) pronotum of *H. salinarius*, (c) and (d) same parts of *H. subguttatus*, Robts.

Localities: From Nova Scotia, and the New England States to British Columbia.

As pointed out by Mr. Roberts, this species is subject to considerable variation in maculation and I am of the opinion that a close study of sufficient series from widely separated localities may reveal differences upon which at least geographical races might be founded.

What appears to be the true *subguttatus* is quite rare in the west, and I have seen probably not more than six or eight specimens from that region. In addition, however, to specimens which, while differing slightly from typical *subguttatus* from the extreme east, are so close as not to be separable from that species, there are, I am convinced, several other species awaiting discovery. I have two females, one from Poison Lake, Lassen Co., California, 30 IX, the other from Lake Lagunitas, Marin Co., California, 18 X, E. C. Van Dyke, which are certainly

different from each other and from anything else I have studied. As I have no males, these females remain undescribed. In regard to the species next to be described, we are more fortunately situated.

(31) **Halplus (Liaphlus) salinarius** sp. nov.

Holotype: ♂ Length 3.96 mm., width 2.11 mm. Elongate oval, nearly evenly narrowed before and behind; quite strongly convex. Colour in general testaceous, the head and pronotal disc more ferruginous,

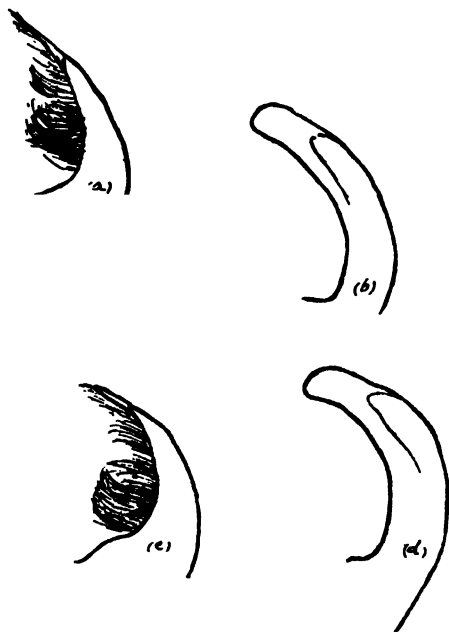


Fig. 28.—(a) Left paramere, (b) aedeagus of *H. salinarius*, sp. nov., holotype, (c) left paramere, (d) aedeagus of *H. subguttatus*, Robts.

but neither the base of head or anterior margin of pronotum with black spot.

Head: Narrow between the eyes, the width of an eye seen from the same point above being about $7/11$ the width of the head between the eyes (Fig. 27a); a little more coarsely punctured than in *subguttatus*, the punctures separated by a little less to a little more than the diameter of a puncture; the punctures behind the transverse impunctate area evidently larger than those in front of it; all the punctures deep.

Pronotum: A little wider in proportion to its depth from back to front than in *subguttatus*, the width being very close to twice the depth in *salinarius*, about $1\frac{1}{2}$ depth in *subguttatus* (Fig. 27 b, d). Punctulation

anteriorly closer and coarser than in *subguttatus*, the discal area with several small smooth areas separated by scattered punctures; a row of quite large blackened punctures across base, the outer ones, as usual, the largest; a shorter more irregular row in front of the basal one. Anterior margin more deeply sinuate and more sharply angulate at middle than in *subguttatus* (Fig. 27 b, d).

Elytra: Striae of deep, blackened punctures, larger than in *subguttatus*, those of the outermost row blackened only in apical fifth, not greatly reduced in size apically or laterally; subsutural row of small punctures single, regular and well separated basally, becoming closer, irregularly double, and more or less crowded apically; those of the other interspaces single and moderately widely separated, all blackened and deep. External angle rounded, apices almost obliquely truncate, apical angle rounded but a little less than right. The punctures, especially behind the middle, with a tendency to be set in blackened circles which often elongate and join one another so that the elytra have a substrigate appearance. Maculate with brownish-black elongate spots or suggestion of spots as follows: posthumeraly on the 5th and 6th striae the colouring surrounding the stria punctures extends into the interspace, but does not fuse except at two interstrial punctures; obliquely inwardly from this is an elongate spot between the 3rd and 4th striae; from the anterior inner corner of this spot a narrow band runs across the interspace and joins the 2nd stria; the 2nd stria is blackened apically to about the posterior end of the spot between the 3rd and 4th striae, here it joins an elongate spot lying between the 1st and 2nd striae, exterior to this spot and a little nearer the apex is a spot between the 5th and 6th striae; exterior to this the 7th and 8th striae are darkened giving a suggestion of a spot in that position; nearer the apex the second stria is darkened and a spot lies between the 3rd and 4th striae; base of elytra not blackened, suture narrowly but intensely blackened from about basal fifth with the usual spear-head at apex.

Prosternal ridge moderately constricted in front of fore coxae where it is about $7/12$ the width at base, thence divergent to apex which is $5/6$ the width of the base, not margined laterally, more finely so than *subguttatus* at the apex; nearly flat, more coarsely punctured than *subguttatus*. *Mid-metasternum* just visibly concave between the coxae so that the "pads" are feebly evident; flat behind with a rather large circular fovea at middle; irregularly and rather closely punctured between the coxae and on each side of the fovea, smooth behind the fovea, the punctures smaller than those on the prosternal ridge and with some minute ones intermixed. The metasternum without margins. *Ante-coxal piece* with a row of regular rather small punctures along its anterior margin, practically smooth behind. *Hind coxal plates* with a regular

row of punctures along their basal margins, these increasing considerably in size laterally and decidedly larger than those on the antecoxal piece. Remainder of punctures moderate in size and closeness, rather deep; hind margins feebly sinuate before angles which are evident but just obtuse.

Sexual characters: Fore and middle tarsal joints somewhat thickened. Fore tarsal claws simple, not elongate, 2nd and 3rd fore tarsal joints combined equal in length to first. Genitalia testaceous; point of left paramere longer than in *subguttatus*; ædæagus less curved and less narrowed in apical fourth than in *subguttatus*, the point about $\frac{4}{5}$ the width at middle (Fig. 28 b, d).

Allotype: ♀ Nearly as in holotype in all respects differing only as follows: the head has a small reddish brown spot at base, the elytral maculation is reduced, in especial the posthumeral and the two obliquely interior spots are reduced to dark shading on the striae, the substrigate appearance of the elytra due to the darkening of the striae is more evident in the basal half, less evident in the apical half than in the holotype. Fore and middle tarsal joints not as thick, but about as long as ♂.

Localities: Holotype and Allotype, Osoyoos, B.C., 4 V 1929 taken under stones on the shores of a saline lake by Mr. Ralph Hopping. The holotype is in the Canadian National Collection, the allotype, through the kindness of Dr. James McDunnough and of Mr. Hopping, in mine. The half-dozen paratypes before me show little variation except in maculation, which has a decided tendency to disappear; but even in those specimens with least maculation the elytra still preserve, to some extent, their substrigate appearance.

This interesting species is very close to *subguttatus* but in no specimen of that species that I have seen are the elytral striae composed of such large, contrasting blackened punctures, nor is there the same tendency to a substrigate appearance in *subguttatus*.

(32) **Haliplus (Liaphlus) vancouverensis** Math., Jour. N.Y. Ent. Soc., XX, Sept. 1912, p. 168.

Type: ♀ Length 4.36 mm. Width 2.38 mm. Evenly, rather broadly oval, sides of elytra not much curved, the greatest width being about the middle of elytra.

Colour: Moderately bright reddish, immaculate, punctures not blackened, those on the elytra a little darker ferruginous than the ground colour of the elytra.

Head: Wide between the eyes, the width of an eye, seen from the same point above, being about nine-sixteenths the width between the eyes (Fig. 29a). Evenly punctate except the usual impunctate trans-

verse area, the punctures between and in front of the eyes separated by about their own width, those at base of head a little larger, a little more irregularly, and, in part, a little more closely placed than those in front. Labrum strongly emarginate.

Pronotum: Rather broadly but feebly infuscate on anterior margin, an exceedingly vague infuscate spot on each side of the middle of the disc; punctulation rather fine and not very close, a few considerably larger punctures towards the sides of the base, the impunctate or sparsely punctate transverse area unusually wide longitudinally of the insect.

Elytra: Interstrial punctures rather large, singly placed, deep. Subsutural rows of interstrial punctures irregularly placed and partially double. Strial punctures not very large, decreasing, but not greatly or suddenly, apically and laterally, those of the two outer rows distinctly the smallest. Apices very feebly curved from external to apical angle.

Prosternum: Ridge moderately and evenly converging from base to nearly the front of the fore coxae where it is about two-thirds the width at base, thence rather widely and rapidly divergent, though scarcely curved, to the apex which is almost exactly as wide as the base. From the constriction to the apex is very steeply declivous. Apex evidently margined, sides not margined. Almost flat medially but with edges a little curved; punctures rather large, separated usually by less than their own diameters in basal half, a little sparser apically.

Mid-metasternum: Widening from base to just behind coxae where it again briefly and slightly narrows; medial third between coxae just visibly depressed, the "pads" at sides darker and more closely punctured than the medial third; a small but rather deep fovea at middle just behind coxae, all this area, especially medially, sparsely punctured.

Ante-coxal piece with a regular row of rather coarse punctures along its anterior margin, a few fine punctures behind this at middle and a second row of coarse ones laterally.

Hind coxal plates punctured much as usual; just visibly sinuate immediately before the inner angles which however are obtuse.

Fore-tarsal claws evidently though not much longer than one-half the claw joint.

Localities: Victoria, Vancouver Island, B.C.

I trust that I may be pardoned for redescribing this very interesting species but having the type before me, through the kindness of Professor H. F. Wickham, it appears to me that in view of the somewhat inadequate original description, it would be proper to do so.

Dr. Zimmermann in "Die Halipliden der Welt," p. 134, recognizes *vancouverensis* as coming from Vancouver, B.C., Washington, and Oregon. From his remarks, however, I feel sure that he did not have

the true *vancouverensis* before him but possibly one of the species described hereinafter.

My reasons for believing that Dr. Zimmermann, doubtless misled by Mr. Matheson's vague description, erred in this instance, are as follows: *vancouverensis* is placed by Dr. Zimmermann in a group characterized by having more or less distinct elytral spots, and with first joint of fore and middle tarsi shorter than next two joints together. It is

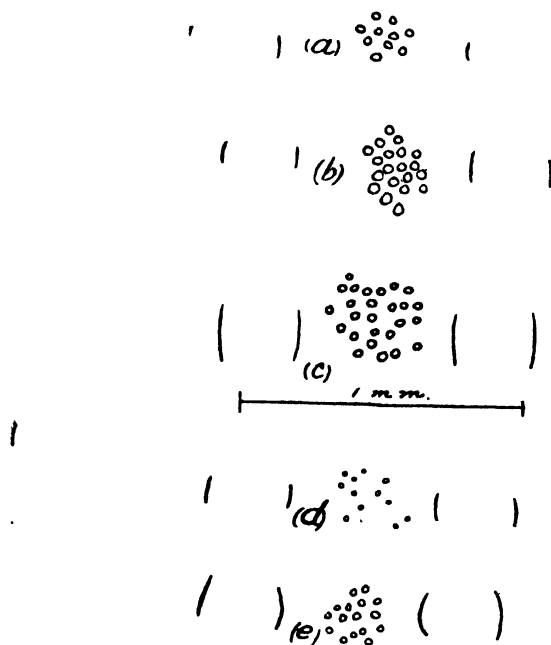


Fig. 29.—Relative width of eyes and of head between eyes, and size of punctures on head of: (a) *H. vancouverensis*, Math., type ♀ (b) *H. salmo*, sp. nov., (c) *H. leechi* sp. nov., (d) *H. columbiensis* sp. nov., (e) *H. ungularis*, sp. nov.

true that in speaking of *vancouverensis* later he says that the brownish longitudinal flecks of the elytra are almost obsolete, only about a single spot feebly hinted at. On *vancouverensis* type I can find absolutely no trace of even this "hint" and the first joint of its fore and middle tarsi seems almost exactly equal to the second and third combined. More convincing, however, is the statement that the stria punctures of the elytra are blackish. In *vancouverensis* type there is not the faintest suggestion anywhere of a blackish marking.

I have a single male specimen taken in Stanley Park, Vancouver, B.C., March 29, 1930, by Mr. Hugh Leech, which I confidently assign

to this species. It is a little smaller, a little less red, the subsutural rows of interstitial punctures more markedly double and the punctures closer but in the other common characters it is in close agreement. The basal joints of the fore and middle tarsi are about equal in length to the next two combined, and the tarsal claws are short, weak, and equal in length and thickness.

The left paramere of the genitalia is unusually broad basally, but narrows rapidly to a long point. The ædœagus is of the *cribrarius* type but rather markedly different from that species. The "fold" is more basal than in *cribrarius*, in fact, more so than in any other of our species; the sides of the ædœagus are parallel for about one-half its length, a little narrower but still parallel for a short distance when it is suddenly angulate on the dorsal edge, whence it is again parallel to the point. This last parallel portion is about one-third the total length and the ædœagus and about seven-tenths the depth at base (Fig. 30).

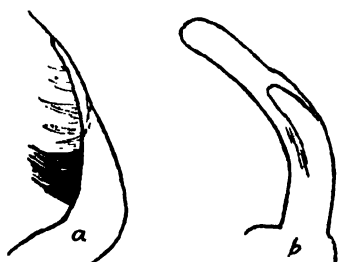


Fig. 30.—(a) Left paramere, (b) ædœagus of *H. vanconverensis*, Math.

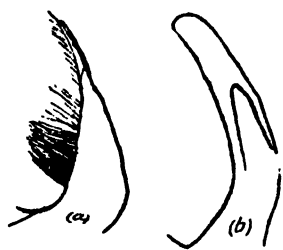


Fig. 31.—(a) Left paramere, (b) ædœagus of *Haliplus salmo*, sp. nov., holotype.

(33) *Haliplus (Liaphlus) salmo* sp. nov.

Holotype: ♂ Length 4.16 mm. Width 2.11 mm. Moderately elongate oval, sides of elytra little curved, greatest width well towards middle of elytra. Brownish red, without maculation except that the pronotum is a little infuscate on anterior margin. Larger punctures at base of pronotum and elytral punctures blackened.

Head: Wide between the eyes, the width of an eye seen from the same point being approximately three-sevenths the width of the head between the eyes (Fig. 29b); quite densely punctured especially so towards the clypeus; a narrow transverse impunctate space between basal margins of eyes, behind which the punctures are a little larger than those in front. Labrum broadly but not deeply emarginate.

Pronotum: Rather densely and moderately coarsely punctured, scarcely less so laterally, the usual smooth transverse medial area present, the punctures behind this a little sparser and larger; and there

is a row of a few large punctures on each side at base running in from basal angle about one-half the distance to the suture.

Elytra: The striae punctures only moderate in size, the largest, except the basal one in the third row, smaller than the largest in the pronotal basal row; not greatly reduced apically or laterally except those of the outermost row. Punctures of the subsutural rows larger than usual, nearly the diameter of the punctures of the first interstriae rows, moderately close and irregularly double throughout. Punctures of the interstriae rows rather large, their diameters being nearly or quite one-half that of the adjacent striae punctures. Apices feebly curved, apical angle a little produced and acute though rounded.

Prosternum: Ridge with sides gently convergent to fore coxae, nearly parallel between, thence rather rapidly excurved to apex, which is scarcely visibly wider than the base, and the narrowest part of the constriction is about eight-elevenths the basal width. Margined at apex but not at sides; nearly flat, strongly and quite closely and evenly punctured. Very steeply declivous in front. *Mid-metasternum*: Rather narrow, the sides quite regularly curved between and behind coxae; nearly flat throughout but with a deep circular fovea at middle; punctulation, except a few punctures towards the ante-coxal piece, about half the diameter of those at the base of the prosternal process, sparse. *Ante-coxal piece* with a transverse row of coarse punctures along its anterior and a row of much finer ones along its posterior margin. *Hind coxal plates* punctured as usual; the apical margins just perceptibly sinuate before the inner angles which are very obtuse.

Sexual characters: Joints of middle and fore tarsi a little stouter than in ♀. First joints of middle and fore tarsi about as long as the combined length of the second and third joints; claws simple, rather weak and a little over half the length of the claw joint. Genitalia testaceous. *Ædœagus* with both dorsal and ventral edges curved equally so that the width is maintained evenly; a little narrower in apical third; dorsal edge more evidently curved at point than the ventral so that the point is nearer the ventral than the dorsal edge (Fig. 31). Left paramere rather gently curved at base, with a tuft of long hairs medially on the lower edge.

Allotype: ♀. Size, shape, colour, nearly exactly as in holotype. Head not quite so closely punctured. No perceptible difference in the characters of the underside, except that the posterior row of smaller punctures on the ante-coxal piece is twice interrupted. Claws of the fore and middle tarsi as in the ♂, the joints not differing much in length from those of the ♂ but somewhat less stout.

Localities: Holotype and Allotype: Buffalo Point, Jasper, Alberta, 22 VIII 26, in my collection. Seven paratypes from the same locality

except one from Wabasso Lake, Jasper, will remain in my collection or will be deposited in the collections of the University of Minnesota, Canadian National Museum, and the American Museum of Natural History.

This species was recorded in the "Reports of the Jasper Park Lakes Investigations, 1925, 1926, No. VI," as *vancouverensis*, Math., but on receiving the type of that species from Professor Wickham the error was at once evident. It is, however, exceedingly close, but is a narrower insect, less brightly red and with its elytral and part of the thoracic punctures blackened.

All the known specimens of this insect were taken from the stomach of a trout, *Salmo irideus* Gibbons, caught by Mr. Ferris Neave of the University of Manitoba, who was in charge of the investigations, so quite possibly the colour may have undergone some change.

(34) **Haliplus (Liaphlus) leechi** sp. nov.

Holotype: ♂ Length 4.16 mm. Width 2.18. Moderately elongate oval, sides of elytra little curved, greatest width well towards middle of elytra. Testaceous with brownish or blackish maculation.

Head: Wide, but not quite as wide between the eyes as *salmo*, the width of an eye seen from the same point being approximately $\frac{3}{5}$ the width of the head between the eyes (Fig. 29c). Moderately deeply and coarsely punctured, the punctures well separated, a little coarser and denser basally between the eyes, those behind the usual impunctate space about as large as the largest in front. Vertex infusate. Labrum scarcely emarginate.

Pronotum: Punctulation moderately sparse, and near anterior margin evidently smaller than the punctures on the adjacent part of the head, becoming larger towards discal impunctate area which does not reach the sides. Basal punctures considerably coarser and blackened. Anterior margin broadly rounded, infusate at middle.

Elytra: Strial punctures a little larger than in the holotype of *salmo*, nearly all in basal third larger than the largest in the pronotal basal row, evidently though not very greatly reduced laterally and apically. Punctures of the subsutural rows about as large as those of the interstrial rows, rather closely set and irregularly double throughout. Diameters of the interstrial punctures about one-third that of the adjacent strial punctures. Apices almost truncate, apical angle just less than right. Punctures, except those of the outermost interstrial and strial rows, blackened. Indefinite brownish maculation as follows. Base of each elytron from 3rd to 6th striae, a small spot at about basal fourth between 5th and 6th striae, one obliquely apically within this between the 3rd

and 4th, and extending vaguely to the 2nd. Two spots side by side post medially between the 5th and 6th and 7th and 8th striae, and behind these the suggestion of a fascia. The suture narrowly and vaguely brown throughout.

Prosternum: Process with sides scarcely convergent to fore coxae, quite strongly constricted between, the narrowest part of the constriction being about at the front of the coxae, where it is about $7/11$ the basal width, thence rather rapidly excurved to the margined apex, which is little if at all wider than the base. Surface very feebly convex from side to side, punctures quite large, close laterally, a little more widely spaced medially, especially apically. No lateral margins. *Mid-metasternum*: Sides divergent between the coxae, sharply but briefly convergent towards the medial fovea behind, without vestige of margins. Surface just visibly convex longitudinally between the coxae, and behind them very feebly depressed so that that portion is on a very slightly different plane. Punctures between coxae same size as on prosternal process, sparser at middle; those at sides of the fovea rather coarser. *Ante-coxal piece* with a row of large punctures along its anterior margin and an interrupted row of smaller ones on its posterior margin. *Hind coxal plates*: Punctures well separated, rather large, especially the exterior anterior ones. Inner angles obtuse.

Sexual characters: Joints of middle and fore tarsi a little stouter than in the ♀. First joints of middle and fore tarsi about as long as combined length of the second and third joints; claws simple, rather weak, a trifle over half the length of the claw joint. Genitalia reddish testaceous. *Ædœagus* a little narrowed in apical fourth, dorsal edge more curved at point than the ventral so that the point is nearer the ventral than the dorsal edge (Fig. 32). Left paramere with a tuft of long hairs medially on the lower edge.

Allotype: ♀ Almost identical with the holotype, the slight differences as follows: anterior pronotal brown spot evident, the basal elytral mark entirely wanting, the others even more indefinite. Mid-metasternum almost flat between coxae and hence the area behind almost exactly on the same plane, punctures smaller. Punctures of coxal plates smaller.

Holotype and Allotype: Vancouver (Stanley Park), B.C. 29 III 1932. H. B. Leech. There are seven topotype paratypes, and one from Vernon, B.C., 2 VIII 1929, H. B. Leech; three from Terrace, B.C., Mrs. W. W. Hippisley; three from Creston, B.C., 8-9 IV 1930, G. Stace Smith; and one from Wynndel, B.C., 13 IV 1930, G. Stace Smith. There is also before me a female from Corvallis, Oregon, 24 VI, labelled *H. gracilis*, Robts., paratype, which I think is this species. It is a little smaller, a little paler in colour so that the maculation appears to be a little more

distinct and with the elytral maculation a little finer, but otherwise it is apparently identical. This specimen belongs to the Canadian National Collection and was sent to me by Mr. W. J. Brown who queried the correctness of its identification as *gracilis*.

The paratypes are all very similar, in most cases differing only in maculation, some specimens losing almost all traces of spots on the elytra. The Wynndel and one of the Terrace specimens show, however, a much more important variation: the subsutural rows of small punctures are scarcely double though an occasional puncture is misplaced. As they agree in all other respects, I have no hesitation in placing them as *leechi*. Such specimens might easily be mistaken for *subguttatus* or *salinarius*. The prosternal process differs markedly in the former, and the width of the head between the eyes is much less in the latter.

The species of *Haliplus* of the subgenus *Liaphlus* from west of the Rocky Mts. form a most puzzling group. Specimens from one valley seem to differ slightly from the same species taken in the others.

Salmo and *leechi* are remarkably alike structurally and it is possible that one is but a geographical race of the other. At present, however, they seem to be separable by the characters given, especially the greater



Fig. 32.—(a) Left paramere, (b) aedeagus of *Haliplus leechi*, sp. nov., holotype.

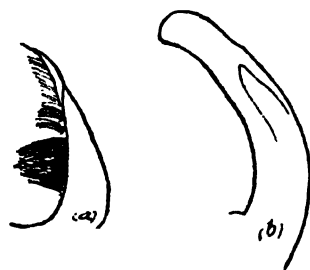


Fig. 33.—(a) Left paramere, (b) aedeagus of *Haliplus columbiensis*, sp. nov., holotype.

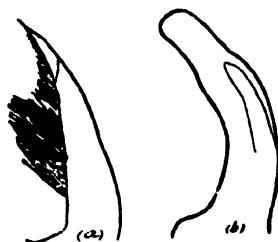


Fig. 34.—(a) Left paramere, (b) aedeagus of *Haliplus angularis*, sp. nov., holotype.

width between the eyes in *salmo*, its reddish colour, immaculate elytra and usually almost immaculate thorax and head, and slight differences in punctulation.

Paratypes of *leechi* will be deposited in the Canadian National Collection, American Museum of Natural History, British Museum, and the private collections of Mr. H. B. Leech, Mr. H. C. Fall and Mr. Chas. Liebeck.

I have been unable to determine to what species Dr. Zimmermann applied the name *vancouverensis* (Op. cit., p. 134). As I have shown under that species, Dr. Zimmermann's is not the *vancouverensis* of Matheson, nor can I fit his description to any of my species. His diagnosis calls for an insect with more or less distinct spots on upperside, unspotted head, 1st joint of fore and middle tarsi shorter than the two following joints combined, subsutural row of small punctures regular, elytral stria punctures scarcely stronger basally, elytral stria punctures closely spaced separated by less than the width of a puncture, stria punctures blackish, maculation almost obsolete, prosternum strongly and densely punctured.

It comes from Vancouver Island, Washington and Oregon.

(35) ***Haliplus* (*Liaphlus*) *columbiensis* sp. nov.**

Holotype: ♂ Length 3.89 mm. Width 1.98 mm. Moderately elongate oval; sides of elytra little curved, sub-parallel in medial third. Brownish red, a little lighter and brighter than *salmo*, not as bright as *vancouverensis*. Head at base and anterior margin of pronotum a little darker; a very vague transverse cloud on disc of pronotum; the elytral suture, three spots on elytra, an elongate post-medial one between first and second striae, and two merely hinted at placed obliquely to the suture and externally of the post-medial spot, the outer the more anterior, all a little darker reddish. Below, much the same colour as above, legs a little darker. Punctures of thorax concolorous or almost so with pronotum, those of elytra blackened.

Head: Wide between the eyes, the width of an eye seen from the same point being just over four-sevenths the width of the head between the eyes (Fig. 29d); unusually finely and sparsely punctate, the punctures irregularly spaced, the anterior ones separated by from one to four or five times their own diameters; the impunctate area rather large; the basal area with somewhat larger and more closely set punctures. Labrum quite deeply emarginate.

Pronotum: Moderately closely but not coarsely punctate behind the anterior margin, the disc from side margin to side margin impunctate or very sparsely punctate; the base, with a row of larger but not very

large punctures, a partial row of smaller ones posteriorly of the large ones medially and another partial row in the middle of each side.

Elytra: Strial punctures rather small, not crowded, somewhat but not greatly reduced apically and laterally, the exterior row small but impressed; interstrial punctures rather large, about half the diameter of adjacent strial punctures, except those of the subsutural rows which are much smaller. These subsutural punctures are rather widely spaced and perfectly single basally becoming closer apically and irregularly double near apex. Apices feebly sinuate, the sutural angles rounded and a little less than right.

Prosternum: Ridge with sides scarcely convergent to front coxae rather strongly constricted between and in front of the coxae, thence rapidly divergent to the apex; the narrowest part of the ridge about seven-elevenths the width of the base, and the apex about nine-elevenths the width of the base, margined at apex but not at sides; surface evidently convex; punctures irregular, sparse, and deep; not particularly steeply declivous in front. *Mid-metasternum* with sides diverging between the coxae, scarcely perceptibly constricted behind, thence very feebly diverging; not margined; a little tumid between coxae, rather broadly but feebly triangularly impressed behind with a fovea at apex of impression; punctulation fine, irregular and very sparse. *Ante-coxal piece* with a row of somewhat coarser punctures along anterior margin, almost perfectly smooth behind. *Hind coxal plates* with coarse and fine punctures intermixed, the largest only moderate in size but deep, the punctulation not decreasing very greatly inwardly but rather suddenly leaving a medial area with only a few sparse, irregularly scattered punctures upon it; inner angles nearly right; an elongate depression medially on suture.

Sexual characters: First joint of middle tarsi about the same length as combined length of the second and third joints; claws of middle tarsi simple, short; genitalia testaceous; left paramere with moderately long golden hair in medial half; ædæagus not much curved, not narrowed except very slightly at apex, point slightly deflexed to left and the lower edge feebly angulate. (See Fig. 33).

Localities: Holotype, Golden, B.C., VIII, 05, in the collection of the American Museum of Natural History by whom it was sent to me as *vancouverensis*.

An interesting and distinct species, the sparse punctulation of the head, pronotum, prosternal process, mid-metasternum and ante-coxal piece being quite unusual. The prosternal process alone will separate it at once from *salmo* and *vancouverensis*.

Unfortunately the front and hind legs all have vanished so that I cannot give the fore tarsal characters. In spite of the absence of the

hind tibiae I feel confident that the species belongs to the sub-genus *Liaphlus*.

I do not think that this can be the species called *vancouverensis* by Zimmermann, as in that the prosternal ridge is strongly and densely punctured.

(36) *Haliphus (Liaphlus) unguaricus* sp. nov.

Holotype: ♂ Length 3.9 mm. Width 2.11 mm. Elongate oval, a little more pointed in front. Ferruginous, practically without maculation, the head, the anterior margin and part of the disc of pronotum, the suture in posterior two-thirds and the suggestion of a post-medial spot between the fifth and sixth striae, a little darker. Elytral punctures blackened.

Head: Rather wide between the eyes, the width of an eye seen from the same point above being a little more than half the width of the head between the eyes (Fig. 29e); finely, evenly and moderately closely punctured anteriorly, more coarsely and closely behind the smooth space, but all punctures evidently coarser than in *columbiensis*.

Pronotum: Rather closely punctured anteriorly, the punctures rather larger than the largest on the head; sparsely punctate at sides, the usual more or less impunctate discal area; the base with a regular row of large close-set punctures complete from side to side, except very briefly at middle, this row with some irregularly arranged and different sized punctures in front of it. The punctures throughout coarser and denser than in *columbiensis*.

Elytra: With striae formed of perfectly rounded, deep, moderate sized punctures, the largest being scarcely as large as the largest on the pronotum; 10th row of unusually large punctures, considerably larger than those of the 9th row, not blackened except near the apex. (In *columbiensis* the punctures of the 10th row are smaller than those of the 9th). Punctures of striae rows not greatly decreasing in size apically or laterally, unusually exactly rounded and sharply defined throughout, the colour of the punctures not extending to the plane of the elytra so that each puncture appears as a sharply defined pit; subsutural rows of fine punctures consisting of small punctures, single and well separated basally, gradually becoming somewhat crowded and irregularly double apically; remainder of the interstriae rows of single, deep punctures, more widely spaced and a little larger than those of the sutural interspace; the marginal beading of the elytra, especially at the apical angles, is considerably narrower in *unguaricus* than in *columbiensis*.

Prosternum: Ridge less constricted in front of fore coxae than in *columbiensis* being there about four-fifths of the width at extreme base; apex a little, but not much, narrower than the extreme base; sides diverging

slightly from extreme base so that the widest part of the process is between the middle and the fore coxae; punctulation coarser, deeper and a little closer than in *columbiensis*; margined apically but not laterally. *Mid-metasternum* almost perfectly flat between the coxae, deeply and rather widely impressed medially behind, so that the lateral portions, which are nearly on the same plane as that between the coxae, are each about one-fourth the total width of the mid-metasternum. Punctures on each side of the depression larger than those on the front portion (not so in *columbiensis*), and all larger than in *columbiensis*; not margined but with the outer edges of the lateral elevated portions on each side of the medial depression quite evident and sharply declivous, while in *columbiensis* these edges are broadly rounded. *Ante-coxal piece* with a regular row of moderately large punctures along anterior margin, a very few large and a few very fine punctures behind, all these being considerably larger than the corresponding punctures in *columbiensis*. *Hind coxal plates* with a regular row of good sized punctures along anterior margin, separated from those behind by a nearly impunctate space; other punctures moderately coarse, deep and not very closely spaced laterally, but towards the medial suture very sparse and much smaller with minute ones intermixed; the medial suture not with an elongate fovea as in *columbiensis*.

Sexual characters: Fore tarsal joints not much dilated, though feebly pedunculate; the claws unusually short with the posterior one a little shorter than the anterior one, moderately curved, mid-tarsal claws less curved, the anterior one just perceptibly shorter and a trifle thicker than the other. Genitalia much as in *columbiensis* but the ædæagus is stouter (Fig. 34).

Localities: Peachland, B.C., 16 VII 19, taken by myself and in my collection.

The four species *vancouverensis* Math., *salmo* Wallis; *columbiensis* Wallis, and *ungularis* Wallis form a group characterized by their laterally unmargined prosternal ridge, unmargined mid-metasternum, and almost complete lack of maculation.

Vancouverensis apparently is the brightest red, the largest, and with its elytral punctures not blackened. *Salmo* has its basal row of pronotal punctures evidently blackened, its ♂ fore-tarsal claws equal and of moderate length, and its ædæagus evidently more slender than in *columbiensis* and *ungularis* (Fig. 31, 33, 34). *Columbiensis* is evidently more finely and sparsely punctured throughout than is *ungularis*; the prosternal ridge and particularly the mid-metasternum differ in the two species. Unfortunately the fore-tarsi of *columbiensis* holotype have completely disappeared so I am unable to make comparison between the claws and fore tarsal joints of the two species. The mid-tarsal joints

of *columbiensis* are more thickened than in *ungularis*. The ædœagus, as already pointed out, is stouter in *ungularis* than in *columbiensis*.

(37) **Haliphus (Liaphlus) gracilis** Robts., Jour. N.Y. Ent. Soc., XXI, June 1913, p. 102.

Narrowly oval, sides nearly parallel. Colour pale testaceous. Pronotal side margins wider than in *subguttatus* and its other close allies.

Elytral striae of moderately large, shallow, brown punctures, much smaller apically and laterally, usually somewhat larger than in *subguttatus*; the maculation of brown spots is placed as follows: two ante-median placed obliquely, one post-median, two below the latter ante-apical. The maculation is never distinct, often evanescent.

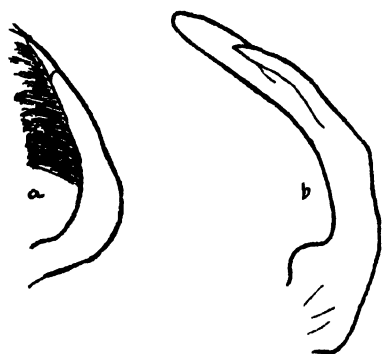


Fig. 35.—(a) Left paramere, (b) ædœagus, (c) right paramere of *H. (Paratype)*.

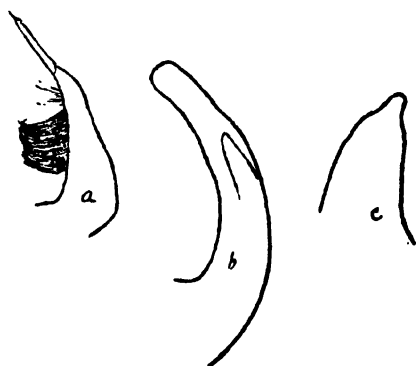


Fig. 36.—(a) Left paramere, (b) ædœagus of *H. gracilis*, Robts., *cylindricus*, Robts.

Posternal ridge flat, sides parallel to front coxae, greatly constricted beyond them and then widely excurved, broadly arched over the declivity; without side margins. Mr. Roberts says also without apical margin but in all specimens I have seen including four paratypes, there is well up (or down) the declivity a faint hair line margin usually but not always incomplete. To see this a somewhat high power should be used and the insect held at the proper angle to the light. Punctulation of process more uneven, and much sparser than in *subguttatus*.

Mid-metasternum a little depressed between, more broadly and deeply behind, the middle coxae; finely but distinctly margined at the sides.

Genitalia of ♂ pale fulvous. Left paramere narrow, gently curved on ventral side near base, ventral edge with moderately long hairs, gradually decreasing in length apically, on apical two-thirds. Aedeagus longer than usual, a sub-angular hump on dorsal edge near basal two-fifths. Sides similarly curved to form point (Fig. 35).

Length 3.5 to 4 mm.

Localities: Corvallis, Oregon, type locality, was the only station from which Mr. Roberts had seen the species. I have seen it also from Lake Lagunitas, Marin Co., California.

This species, when carefully examined, should give little trouble in determination though strangely enough I have before me now a specimen labelled "*gracilis*, paratype," which is really *leechi*, or an exceedingly closely allied species. This specimen is from the type locality of *gracilis*, but unfortunately is a ♀.

Again I cannot understand how Mr. Roberts overlooked the apical beading of the prosternal process though it may not be present in his types. Probably the power he used was not sufficiently high to show the fine margin traceable as a hair-like line.

From all its close allies *gracilis* may be distinguished by its margined metasternum.

(38) **Haliplus (Liaphlus) cylindricus** Robts., Journal N.Y. Ent. Soc., Vol. XXI, June 1913, p. 102.

Elongate, oval, convex, pale olive yellow. ;

Head finely, evenly, lightly punctured except at vertex. Prothorax finely punctured apically, disc sparsely punctured, base with a double row of coarse black punctures, a transverse, median, basal depression. Elytral striae of moderate sized, deep, blackened punctures, gradually reduced in size apically. Prosternal process widest at base, a little constricted before front coxae, evenly, deeply, closely, punctate; sides and apex finely margined. Mid-metasternum nearly flat, sparsely punctured, without margins and with a round fovea at middle. Length 4.5. mm. Width 2.25 mm.

Localities: Twin Lakes, California, the type locality, is the only station from which I have seen this interesting species.

The above is an abbreviation of the original description. Mr. Roberts' type was without elytral markings but this is not always the case as in a specimen before me now there is an oblique post-medial row of three oblong brownish spots on each elytron. Also the double row of blackened punctures at the base of the pronotum tends to become confused. The lateral margin of the prosternal ridge seems to be as much a result of the roughening of the edge by punctures as of an actual raising of the edge. *Cylindricus* should, however, be easy to recognize, its elongate form, blackened elytral striae, prosternal and metasternal characters, defining it satisfactorily. The genitalia are figured in Fig. 36.

(39) **Haliplus (Liaphlus) tumidus** Lec., Trans. Am. Ent. Soc., VIII, p. 166.

Broadly and acutely ovate, testaceous to dark reddish brown, pronotum broadly infusate apically and basally. In well marked specimens the elytra are maculate as follows: base, suture, a large medial blotch, an interior discal spot, an exterior discal spot, a posterior subsutural, and an outer subapical, spot, piceous. In the dark coloured specimens the maculation is frequently scarcely discernible. Elytral margins and apices distinctly serrulate, humeri evidently asperate. Basal punctures of lateral elytral rows much enlarged, especially those of the eighth and ninth striae; suddenly and very much smaller apically.

Prosternal ridge slightly widened from base almost to apex, margined laterally and apically, feebly convex to the declivity thence evidently hollowed out; coarsely sparsely punctured.

Mid-metasternum strongly margined, the margins, however, apparently formed by a deep impression and several large impressed punctures arranged in a longitudinal row on each side. In addition, next the prosternal ridge, there are two impressions at the base of the mid-metasternum.

Length 3 mm.

Localities: Texas, California.

Mr. Roberts (Journ. N.Y. Ent. Socy., June 1913, p. 104), says that all specimens of this species seen by him were from Texas. I have before me now two specimens labelled "California," one of which was kindly compared for me with the type of *tumidus* by Mr. W. J. Brown of the Dominion of Canada Entomological Branch and which undoubtedly are of this species. They may, of course, be incorrectly labelled.

The peculiar mid-metasternum and the asperate elytral humeri define this species perfectly. The genitalia evidently differ from those of *concolor* and are figured in Fig. 37.

(40) ***Haliphus* (*Liaphlus*) *concolor***, Lec., Ann. Lyc. Nat. Hist., V, 1852, p. 201.

Oval, not as broad as *tumidus*; dark ferruginous; usually concolorous, occasionally with indistinct maculation. Elytral margins feebly serru-



Fig. 37.—(a) Left paramere, (b) ædæagus of *H. tumidus*.
Lec.



Fig. 38.—(a) Left paramere, (b) ædæagus, (c) right paramere of
H. concolor, Lec.

late, humeri not in the least asperate but shining and almost smooth, with a few fine punctures only; basal punctures of lateral rows not conspicuously enlarged, though evidently larger than those near the suture, and decreasing in size apically less suddenly and greatly than in *tumidus*.

Prosternal process with sides scarcely divergent apically, nearly parallel; acutely margined; very feebly convex throughout and not hollowed out apically.

Mid-metasternum with a deep pit on each side, the margins very slight but long.

Length 2.5 mm. to 3 mm.

Localities: Colorado River (type locality), California.

Another easily recognized species, it being with *tumidus* distinguished from all our other species by the paired impressions of the mid-metasternum. From *tumidus* the almost smooth, shining humeri will separate it. Compare the genitalia, Fig. 38, with those of *tumidus*, Fig. 37.;

LIST OF SPECIES OF *Haliplus* FROM NORTH AMERICA NORTH OF MEXICO
WITH ORIGINAL CITATIONS

1. *H. strigatus*, Robts., Jour. N.Y. Ent. Soc., Vol. XXI, No. 2, June 1913, p. 110.
2. *H. robertsi*, A. Zimm., Die Halipliden der Welt, in "Entomologische Blätter," XX, 1924, p. 73.
H. pallidus, Robts., op. cit., p. 109.
3. *H. dorsomaculatus*, A. Zimm., op. cit., p. 75.
4. *H. distinctus*, sp. nov.
5. *H. hoppingi*, sp. nov.
6. *H. longulus*, Lec., Lake Superior, Agassiz and Cabot, 1850, p. 211.
7. *H. immaculicollis*, Harr., New England Farmer, VII, 1828, p. 164.
H. americanus, Aubé., Spec. Hydr. VI, 1838.
H. impressus, Kby. Fn. Bor. Amer. 1837, p. 65.
8. *H. blanchardi*, Robts., op. cit., p. 108.
9. *H. borealis*, Lec., Lake Superior, Agassiz and Cabot, 1850, p. 212.
10. *H. lewisii*, Crotch., Trans. Amer. Ent. Soc., IV, 1873, p. 384.
11. *H. ohioensis*, sp. nov.
12. *H. minor*, A. Zimm., op. cit., p. 192.
13. *H. annulatus*, Robts., op. cit., p. 107.
14. *H. confluentus*, Robts., op. cit., p. 106.
15. *H. triopsis*, Say. Trans. Amer. Phil. Soc., 11, 1825, p. 106.
16. *H. pantherinus*, Aubé. Species Gén. des Col., VI, 1838, p. 29.
17. *H. deceptus*, Math., Jour. N.Y. Ent. Soc., XX, Sept. 1912, p. 166.
H. suturalis, Robts., op. cit., p. 96.

18. *H. punctatus*, Aubé., op. cit., p. 32.
19. *H. mutchleri*, sp. nov.
20. *H. leopardus*, Robts., op. cit., p. 98.
21. *H. pseudofasciatus*, sp. nov.
22. *H. fasciatus*, Aubé., op. cit., p. 29.
23. *H. connexus*, Math., op. cit., p. 164.
24. *H. mimeticus*, Math., op. cit., p. 168.
25. *H. rugosus*, Robts., op. cit., p. 102.
26. *H. apostolicus*, sp. nov.
27. *H. cribrarius*, Lec., Lake Superior, Agassiz and Cabot, 1850, p. 202.
28. *H. canadensis*, sp. nov.
29. *H. nitens*, Lec., op. cit., p. 212.
30. *H. subguttatus*, Robts., op. cit., p. 101.
31. *H. salinarius*, sp. nov.
32. *H. vancouverensis*, Math., op. cit., p. 168.
33. *H. salmo*, sp. nov.
34. *H. leechi*, sp. nov.
35. *H. columbiensis*, sp. nov.
36. *H. unguularis*, sp. nov.
37. *H. gracilis*, Robts., op. cit., p. 102.
38. *H. cylindricus*, Robts., op. cit., p. 102.
39. *H. tumidus*, Lec., Trans. Amer. Ent. Soc., VIII, p. 166.
40. *H. concolor*, Lec., Ann. Lyc. Nat. Hist., V, 1852, p. 201.

ADDENDUM

The following interesting species came to hand too late to be included in the preceding study. It should, however, be easy to interpolate it.

10a (—) *Haliplus* (*Paraliaphlus*) *oklahomensis*, sp. nov.

Holotype ♂: Length 2.42 mm., width 1.41 mm. Oval, ferruginous, maculate with dark brown, appendages paler.

Head: Width of an eye about $5/6$ width of head between the eyes. Punctures rather small, deep, evenly distributed but well separated. Very feebly darker basally.

Pronotum: Punctures all somewhat larger than those on head, moderately close and evenly distributed on apical third, sparser and more irregular basally, except the basal row which is almost perfectly regular, its punctures larger and crowded. There is a feeble infuscation at the middle of the base at each side, indicating a pair of round basal spots.

Elytra: Seen from above pronotal-elytral angle more pronounced than in its allies so that the species is broader behind the humeri. Punctures of the inner stria rows small, but little reduced apically, those of the three outer rows considerably larger. Sutural interval with regular, deep punctures mostly about half the diameter of the adjacent stria punctures. Remainder of the intervals with sparse deep punctures. Maculate as follows: Base to fifth stria and suture about in basal half, especially along first and second stria and remainder of suture to and including second stria with rather pale brown; two elongate spots in front of middle between third and fourth, fifth and sixth stria; two behind these between the fifth and sixth and seventh and eighth stria, one obliquely within these between the third and fourth stria, all rather pale brown, and an oval subapical exterior spot a little darker. Sides serrulate over the humeri for nearly half their length, apices evidently though not very strongly serrulate.

Prosternum: Almost parallel in basal half, evidently though not strongly divergent apically, the base about five-sevenths of the width at apex. Strongly margined in apical half and at apex, the remainder of the margin apparently formed by coarse punctures just within the margin. Convex laterally except apically, the convexity with a few fine punctures.

Mid-metasternum: Deeply and obliquely impressed at each side behind, the impressions reaching about half way to the ante-coxal piece. Convex and almost smooth between the impressions, otherwise with a few deep but not large punctures.

Antecoxal piece with two rather regular rows of rather small deep punctures.

Coxal plates: Rather deeply but not closely punctured with considerably smaller punctures than in *confluentus*. Apices just visibly sinuate before the angles which are right though broadly rounded.

Sexual characters: Tarsal joints thicker than in ♀, not pedunculate. Genitalia very similar to *lewisii* but darker in colour, the aedoeagus is not quite the same shape, and the right paramere is a little emarginate on its lower edge below the apex.

Allotype ♀: As in the holotype except as follows: a little larger, 2.56 mm. long, 1.44 mm. wide; darker ferruginous with the elytral spots confluent with those adjacent to them or with the sutural stripe.

Holotype and Allotype: McClain Co., Oklahoma, 10, V. 32, W. F. Fisher, in my collection. Two ♀ paratypes, the same data, are in the collection of Professor R. D. Bird of Norman, Oklahoma.

This species is very close to *lewisii* but is larger and darker, rather wider proportionally, the elytral apices less conspicuously serrulate, and with differences in punctuation and of the prosternum and metasternum.

The darker form represented by the allotype is very much like the lighter, less confluent marked specimens of *confluentus* but may be instantly separated by its serrulate elytral apices.

The two paratypes are a trifle larger than the allotypes so that the holotype is the smallest of the four specimens known. The paratypes are intermediate in maculation between the holotype and allotype.

In the key *oklahomensis* will come next to *lewisii* and may be numbered 10a.

COLLEMBOLA OF THE TORONTO REGION WITH NOTES ON THE BIOLOGY OF ISOTOMA PALUSTRIS MUELLER

By HEDLEY G. JAMES

INTRODUCTION

Canadian records of the Order Collembola are very limited. In 1919, twelve species were listed in the Report of the Canadian Arctic Expedition, 1913-18. Since then, Mr. Charles Macnamara of Arnprior, has described several new Ontario forms, and has also contributed to the biology of his local fauna. In addition, Dr. J. W. Folsom, formerly of the University of Illinois, has determined separate collections, and these scattered Canadian records have appeared from time to time in his publications. Only from these sources data exist.

Under these circumstances it was decided to study the Collembola in the vicinity of Toronto with a view of including the majority of species common to southern Ontario. During 1930, collecting was confined to Toronto and suburbs. Later, during the summer of 1931, opportunities were afforded to collect eastward at Belleville, Kingston and Ottawa, and also in western Ontario at Chatham and Rondeau National Park. In this paper 74 forms are recorded from Ontario, including 7 varieties and 6 new species. Specimens collected by the writer will be deposited in the collection of the Royal Ontario Museum of Zoology.

ACKNOWLEDGMENTS

The author wishes to thank Dr. B. A. Bensley and the Department of Biology for a Research Assistantship extending over a period of two years. Dr. E. M. Walker's guidance and valuable suggestions during the progress of the work are greatly appreciated. Finally, to Dr. J. W. Folsom of the U.S. Bureau of Entomology, special thanks are due for checking most of the more difficult determinations of the Arthropleona.

METHODS AND TECHNIQUE

In field collecting, specimens for systematic study were captured by means of small camel's-hair brushes soaked in special fixing fluids. Jackson's aceto-alcohol mixture proved to be the most satisfactory for preserving the colour of the insects. It consists of 50% absolute ethyl alcohol together with 50% glacial acetic acid saturated with corrosive sublimate. For such specimens which required a minute study of the

furcula, Dr. Folsom's method was adopted, that is, specimens were brought in alive and quickly subjected to boiling 95% alcohol. After fixation in the collecting fluids, all specimens were transferred to 80% alcohol.

Live specimens for observation and rearing were taken with the bits of bark or leaves on which they were found, and placed in 2 inch vials. The latter were kept moist by pieces of damp wood or filter paper. Some of the more active forms were taken from their habitat with less injury by means of a glass sucking tube device, and then transferred to vials.

Whenever possible, the specimens were first examined alive under the binoculars. Later as fixed specimens, they were mounted either in 85% alcohol or in glycerine jelly, and then examined under a compound lens. During the examination of the delicate characters of the eyes, antennae and claws, it was necessary to clear the pigment with a solution of potassium hydroxide, (5-10%). After dehydration, permanent mounts were made using Canada Balsam as a medium.

HABITATS

It is recognized that one of the essential requirements for the Collembolan habitat is suitable humidity. This condition is usually fulfilled in the deep humus layer of the woods, and under the damp bark of trees. The humus is the richest in the number of species and may contain half the fauna of a given locality. This abundance of species may be owing to the fact that the humus overlaps other more restricted habitats. For example, forms are present in the leaf debris which elsewhere are usually taken from beneath stones or in moss. Many other examples might be given. In collecting, however, it was noted that certain forms were repeatedly taken from similar habitats. It is upon this basis only that the following observations are presented, not upon any special ecological study.

FORMS INHABITING MOSS

Mingling with the soil and humus fauna were the moss-dwelling forms. The latter, in contrast to the white and grey soil species, have definite pigment designs. This is chiefly true of *Orchesella* and *Isotoma* which are included in the following list:

Proisotoma ewingi

P. similis

Isotoma palustris

I. palustris var. *balteata*

I. viridis

I. violacea

Entomobrya purpurascens

E. flava

Orchesella ainsliei

O. hexfasciata

O. folsomi

Lepidocyrtus cyaneus

AQUATIC FORMS

The Collembola frequently found on water may be grouped into,
 (a) littoral forms, commonly found under stones or wood on lake shores;
 (b) forms occurring upon standing water at pond and stream margins.
 The latter are structurally adapted for life on the surface layer. *Isotoma palustris*, although not specialized, is common to both habitats.

(a) *Anurida granaria*

A. tullbergi

Achorutes guthriei

(b) *Podura aquatica*

Bourletiella spinata

TREE-DWELLING COLLEMBOLA

Many species were collected upon and under the bark of both living and dead trees. In separating this group, the obvious factor was moisture. For example, the lower degenerate forms such as *Pseudachorutes*, *Onychiurus* and *Neanura*, were usually found buried in wet woody layers of logs. Of the remainder, species of *Achorutes* and *Isotoma* were confined usually to the damp bark at the bases of mature trees, while species of *Entomobrya* and *Sira* were found on the drier, upper parts of the trunk. The following were taken both upon and under the bark:

Achorutes packardi var. *dentatus*

Isotoma leonina

I. (Vertagopus) cinerea

Folsomia bidenticula

Lepidocyrtus cyaneus

Sira buskii

S. nigromaculata

Entomobrya assuta

E. flava

E. clitellaria

E. purpurascens

E. ontarionensis

E. multifasciata

NOTES ON ENTOMOBRYA MULTIFASCIATA TULLB.

Members of the genus *Entomobrya* are very common upon and under the bark of trees of widely separated groups. It appeared that there might be possibly a relation between a species of *Entomobrya* and its tree habitat. Accordingly, from this standpoint, observations were made on the tree habitats of *E. multifasciata* Tullb. Specimens were collected from the bark of the following trees:

Pinus resinosa

Larix laricina

Tsuga canadensis

Abies balsamea

Betula lutea

Salix nigra

Carpinus caroliniana

Ulmus fulva

Crataegus sp.

Quercus rubra

Rhus typhina

Acer saccharum

While collecting in the Don Valley, Toronto, on April 11, 1931,

numerous individuals were observed on the rough algae-covered bark of red oak, and upon the smoother bark of sumach and blue beech. When examined through a hand-lens, the minute insects appeared to be feeding on the coating of algae. Incidentally, this green-banded *Entomobrya* matched its habitat closely, and made observation difficult with the naked eye. Later examination of some of these, under the high power of a compound lens, showed that 80 per cent. of the gut contents consisted of clumps of algal cells of the genus *Pleurococcus*. The remainder included fungus mycelia and several brown teleutospores.

In specimens collected on elm bark from the same locality, on April 28, 1932, the gut contents were found to be partly digested. In this case they consisted of finely divided green oil globules in which could be seen the colourless remains of the cell walls of *Pleurococcus*. These observations would indicate that algal associations govern to some extent the presence of *Entomobrya multifasciata* upon the bark of different trees.

DOMESTIC FORMS

The two usual domestic springtails were taken in the Biological Building of the University. *Sira buskii* was found on the wooden shelves of the aquarium and also upon the rough plastered wall over one of the sinks. *Sira nigromaculata* was taken on window sills of the second floor. These two species, however, were not confined to buildings, but were found to occur outdoors in the driest collembolan habitats.

OBSERVATIONS ON THE LIFE HISTORY OF *ISOTOMA PALUSTRIS* VAR. *BALTEATA* REUT.

During the summer of 1931, while the writer was engaged as an assistant at the Dominion Parasite Laboratory, at Belleville, representative Collembola, including *Lepidocyrtus*, *Tomocerus*, *Isotoma*, and *Heteromurus*, were reared in vials. No trouble was experienced in keeping the insects alive, but no eggs were secured until the beginning of September. A variety of *Isotoma palustris* Müller, very common in the laboratory greenhouse, was finally selected as the form most suitable for observation.

METHODS

The sexual dimorphism exhibited by *Archisotoma besselsi* Packard, mentioned by J. R. Denis (1926), could not be applied in determining the sex of live specimens of *Isotoma palustris*. The best indication of an egg-laying female was its slightly distended abdomen. Such individuals were captured alive by a glass "sucking-tube" apparatus, and transferred to two inch wide-neck rearing vials, containing plenty of wet decaying wood. When eggs were laid, they were isolated in similar

vials provided with moist blotting paper, and damp absorbent cotton stoppers. During September the vials were kept in the shade on the floor of one of the greenhouse compartments, in which the daily temperature averaged about 30° C. Later, in October, rearing was continued in the laboratory at the University of Toronto. As far as possible, the contents of each vial were examined daily under a pair of binoculars, and the different larval stages were noted.

VIAL NO. I

| Date Observed | Larvae Observed | Average Length of Larvae | Stage | Time Interval | Remarks |
|---------------|-----------------|--------------------------|-------|--------------------|---------------------------------------|
| Sept. 3 | | | | | *8+8 eggs isolated |
| " 13 | 5 | .27 mm. | No. 1 | 10 days incubation | Larvae pink |
| " 14 | 5 | | " | | 5 unhatched eggs |
| " 17 | 9 | .55 mm. | No. 2 | 4 days | Larvae pale green |
| " 23 | 10 | .7 mm. | No. 3 | 3 " | " " " |
| " 28 | 10 | | No. 4 | 5 " | 9 exuviae removed larvae, all dead |

*Indicates two egg masses, each with 8 eggs.

VIAL NO. II

| Date Observed | Larvae Observed | Average Length of Larvae | Stage | Time Interval | Remarks |
|---------------|-----------------|--------------------------|-------|---------------|---|
| Sept. 12 | | | | | 16+5 eggs isolated; diameter .16 mm. |
| " 20 | 4 | No measurements taken | No. 1 | 7-8 days | Eggs with a reddish tinge, larvae pink |
| " 22 | 7 | .46 mm. | No. 2 | 2 " | Larvae pale green |
| " 28 | 5 | .69 mm. | No. 3 | 6 " | " " " |
| Oct. 5 | 2 | 1.0 mm. | No. 4 | 7 " | |
| " 8 | 2 | 1.1 mm. | No. 5 | 3 " | |
| " 16 | 2 | 1.17 mm. | No. 6 | 8 " | |
| " 19 | 2 | 1.3 mm. | No. 7 | 3 " | |
| " 23 | 2 | 1.3 mm. | No. 8 | 4 " | |

VIAL NO. III

| Date Observed | Larvae Observed | Average Length of Larvae | Stage | Time Interval | Remarks |
|---------------|-----------------|--------------------------|-------|---------------|--------------------------|
| Sept. 13 | | | | | 25 eggs in a single mass |
| " 23 | | | | | Many eggs unhatched |
| Oct. 6 | 5 | .72 mm. | No. 3 | 23 days | Larvae pale green |
| " 8 | 4 | 1.05 mm. | No. 4 | 2 " | 3 exuviae removed |
| " 14 | 4 | 1.12 mm. | No. 5 | 6 " | 3 " " |
| " 19 | 4 | 1.16 mm. | No. 6 | 5 " | 4 " " |
| " 23 | 4 | 1.36 mm. | No. 7 | 4 " | 2 " " |
| " 27 | 4 | 1.36 mm. | No. 8 | 4 " | 2 " " |
| Nov. 2 | 2 | 1.36 mm. | No. 9 | 5 " | 2 " " |

THE EGG

In the greenhouse, the eggs were found in the soil of the strawberry beds, under damp bits of rotten wood. In the vials they were laid upon similar wood, usually in batches of eight or more, sometimes, however, they were scattered singly. Oviposition was not observed. Within a few hours after oviposition, the eggs varied in diameter from .16 to .17 mm., being spherical and a light cream colour. Under temperature conditions similar to those of their natural habitat the eggs incubated in from 10 to 15 days.

POST-EMBRYONIC DEVELOPMENT

The preceding tables show that after hatching, the larvae moulted at irregular intervals, requiring about one month to reach stage No. 7. Following this stage, for some unknown cause the larvae showed no appreciable increase in length. They appeared active enough in feeding and continued to moult regularly, but never reached the average length (2 mm.) of adults.

GROWTH RELATIONS

Additional data on the immature stages of this species were secured by studying fixed material. Measurements were taken of the total length of each individual, its head-width, and the lengths of its antennal segments. At the same time the minute characters of the claws and the mucro were examined. The average lengths for each recorded stage have been expressed in the following ratios:

| Stages (Approx.) | Antennal Length: Head-width | Antennal Segment Segment III: IV | Head-width: Total Length |
|---------------------|--------------------------------|-------------------------------------|-----------------------------|
| No. 2 | 1.46 : 1 | 1 : 2.1 | 1 : 5.3 |
| No. 3 | 1.52 : | : 1.7 | : 5.18 |
| No. 6 | 1.96 : | : 1.4 | : 6.3 |
| No. 7 | 1.9 : | : 1.1 | : 5.6 |
| No. 7 | 2.0 : | : 1.1 | : 5.9 |

DISCUSSION

That the antennae were proportionately shorter (and thicker) in the initial stages, especially in the first three, is indicated by the above ratios. It may be seen that the third antennal segment almost doubled its initial relation to the fourth. As observed under high power, the antennal segments appeared to be swollen apically, and also slightly telescoped. This would suggest that although segmental ratios might be applied taxonomically in determining adults of this species, they would be of little value in identifying immature stages. It was noted

that the specific characters of the furcula, claws and clothing, were, of course, well developed in the first stage. However, in the dentition of the superior claw an exception appears, in that the lateral proximal tooth was not clearly defined until stage No. 3.

The eye-patches were comparatively larger in the earlier stages, but the eyes themselves agreed in number and arrangement with those of the adult. The areas of green pigment and the characteristic markings, were all faintly outlined after the first moult. Following this, the pigment became darker.

PART II

SYSTEMATIC

Literature

After Nicolet's memoir in 1841, the most important revival of interest in the Collembola occurred in Europe during 1872. At that time Sir John Lubbock's extensive Monograph of the Collembola and Thysanura was completed, although not published until the following year. It included, in addition to his own work, a broad survey of all previous research. In 1872, Tullberg's outstanding paper, *Sveriges Podurider*, appeared, in which particular attention was paid to structural details of the insects. As a result, his original descriptions, especially those of the Family Poduridae, have required little revision. Among the important investigators who followed his methods were Reuter (1876-98), Brook (1883), Schäffer (1891-6), and Schött (1891-6). From 1901, Börner's study of the Order by more refined methods, resulted in a new scheme of classification, which was soon adopted in Europe. The most recent comprehensive paper was published by Linnaniemi in 1912 on European forms, and can be used to advantage by the American student.

In the United States, new species were described as early as 1841 by Say, and later by Fitch (1862), Ryder (1879), and Packard (1873), all of which were based mostly upon gross, structural characters and pigmentation. From 1892 to 1900, several species were described more carefully by Harvey in Maine, and during the same period MacGillivray redescribed many of Packard's forms and made other important contributions to the Collembola of North America. Guthrie in 1903 included fifty-eight species in his Minnesota list, eighteen of which were named as new to science. Since then, the most valuable contributions have been made by Folsom since 1902. His papers on several sub-families, involving a study of types of previous investigators, contain all the known American species.

Classification

In this paper a synopsis of Börner's classification has been used, suited to include the representative subfamilies and genera of the local fauna. Where a genus involves a large number of species, keys have been submitted for their easier determination. For complete descriptions of species already described, one is referred to the original papers listed in the bibliography. In such cases, where original descriptions are inadequate in regard to variations in structure or pigmentation, additional notes are given.

ORDER COLLEMBOLA LUBBOCK

1. Elongate insects with distinctly segmented thorax and abdomen.
Suborder *Arthropleona* Börn.
2. Insects of globular form with thorax and abdomen indistinctly segmented.
Suborder *Symphyleona* Börn.

SUBORDER ARTHROPLEONA BÖRNER

1. Prothorax well developed, antennae short and four jointed, cuticle granular.
Family *Poduridae* Lubb., Börn.
2. Prothorax poorly developed, antennae 4-6 jointed, cuticle more strongly chitinized.
Family *Entomobryidae* Töm.

KEY TO THE SUBFAMILIES OF THE PODURIDAE

1. Head prognathous, eyes when present situated in the anterior region of the head; dentes when present, straight and not annulated. . . . 2
Head hypognathous, eyes on the posterior edge of the head; dentes bowed and annulated. *Podurinae* Börn. (p. 85)
2. Head and body with pseudocelli, postantennal organs usually present and well developed. *Onychiurinae* Börn. (p. 85)
Head and body without pseudocelli. 3
3. Mouth-parts mandibulate, not projecting in a cone; furcula present.
Achorulinae Börn. (p. 86)
Mouth-parts mandibulate or piercing suctorial; mandibles small or absent, without molar surface. *Neanurinae* Börn. (p. 90)

KEY TO THE SUBFAMILIES OF THE ENTOMOBRYIDAE

1. Abd. III and IV usually of equal length; hairs simple or feathered on one side; scales absent. *Isotominae* Schffr. (p. 92)
Abd. III and IV unequal in length; fine sensory hairs present, feathered on all sides; scales present or absent. 2
2. Abd. III longer than IV; scales present, longitudinally ribbed; last

two segments of antennae secondarily annulated; dentes three-jointed.

Tomocerinae Schffr. (p. 100)

Abd. III shorter than IV; scales present or absent; segments of antennae simple; dentes with a single joint.

Entomobryinae Schffr., Börn. (p. 102)

SUBORDER SYMPHYPLEONA BÖRN.

1. Antennae inserted in front of middle of the head, shorter than head diagonal; head without elevated vertex.

Family *Neelidae* Fols.

2. Antennae inserted behind the middle of the head, shorter than the head diagonal; head with elevated vertex.

Family *Sminthuridae* Lubbo.

KEY TO THE SUBFAMILIES OF THE SMINTHURIDAE

1. Ventral tube without tubercles. *Sminthuridinae* Börn. (p. 110)
Ventral tube with tubercles.....2
2. Antennae bent between joints III and IV, joint IV longer than III,
III simple; cuticle smooth. *Sminthurinae* Börn. (p. 111)
Antennae bent between joints II and III, joint IV shorter than III,
III secondarily subdivided; cuticle granular.
Dicyrtominae Börn. (p. 112)

Subfam. Podurinae

Represented by a single genus and species.

Podura aquatica L.

Dark blue with brown legs and furcula. Head hypognathous. Eyes 8+8. Antennae shorter than head, postantennal organ reduced. Ungues long, curving and unidentate on inner margin. Inferior claw rudimentary. Furcula attaining first pair of legs. Dentes strongly bowed outwards. Length 1.3 mm.

Pottageville, May 11, 1931. Very plentiful on muddy shores of spring pond.

De Grassi Point, Lake Simcoe, May 23, 1915, E. M. Walker.

Subfam. Onychiurinae

KEY TO GENUS ONYCHIURUS

1. Tubercles of postantennal organ simple.....2
Tubercles of postantennal organ compound, consisting of about 13 peripheral tubercles; pseudocelli at bases of antennae, 2+2.
ramosus Fols.

2. Pseudocelli at antennal bases 2+2 or 3+3, arranged in a straight line; anal spines one half as long as hind ungues. *subtenuis* Fols.
 Pseudocelli at antennal bases, 3+3, arranged in a triangle; anal spines sub-equal to hind ungues. *armatus* Tullb.

Onychiurus ramosus Fols.

White. Postantennal organ with 13 compound tubercles. Pseudocelli as follows: bases of antennae, 2+2 (oblique); thorax, 0, 1+1, 1+1; abdomen, 1+1, 0, 0, 2+2, 2+2, 0. Ungues untoothed. Inferior claw tapering, about one-half as long as unguis in two specimens, but almost equal to unguis in one atypical individual.

Rondeau Park, Oct. 2, 1931; taken from wet inner wood of a decaying log.

Onychiurus subtenuis Fols.

White. Postantennal organ with 13 biramous tubercles. Pseudocelli: bases of antennae, 3+3 in a straight line; thorax, 0, 1+1, 1+1; abdomen, 1+1, 1+1, 0, 2+2, 3+3, 0. Pro-ungues unidentate one-third from base. Inferior claw half the length of the latter, but not distally filiform as in Folsom's figure. Arrangement of pseudocelli typical. Length 1.7 mm.

Rondeau Park, Oct. 4, 1931; found in a damp log at swamp levels.

Niagara Glen, Nov. 1, 1931; in leaf mould. In these specimens, the pseudocelli at the antennal bases are 3+3, thus agreeing with Folsom's New York and Illinois forms.

Onychiurus armatus Tullb.

White. Postantennal organ with 25-40 simple tubercles. Pseudocelli at bases of antennae, 3+3, arranged in a triangle; at posterior margin of head 3+3; thorax, including dorsal and lateral pseudocelli, 1+1, 3+3, 3+3; abdomen, 3+3, 3+3, 3+3, 3+3, 3+3. Ungues untoothed. Inferior claw as long as unguis, tapering. Anal spines almost as long as hind ungues. This species is somewhat variable in regard to the arrangement of its pseudocelli.

Belleville, May 21, 1931; under limestone flags.

Chatham, July 24, 1931; common in rotting corn stubble.

Niagara Glen, Nov. 15, 1931; very common with *Achorutes macgillivrayi*, on fallen leaves.

Subfam. Achorutinae.

1. Eyes 5+5. Unguiculus absent. Postantennal organ absent.

Xenylla Tullb.

2. A—Eyes 8+8. Unguiculus present. Postantennal organ present,
 composed of 4-5 tubercles. *Achorutes* Temp.
 B—Unguiculus absent. Subgenus *Schottella* Schffr.

Xenylla humicola (Fabricius) Tullb.

"Dark blue. Eyes 5+5. Antennae slightly shorter than the head. . . . Unguis curving, with inner margin unidentate, one-third from apex. Tenent hairs, two, knobbed. . . . Mucro clearly articulated with dens, slightly longer than hind unguis, gradually tapering, with a narrow lamella terminating before the apex, and with a sharp ventral incision about one-third from the base. Anal spines two, minute, conical, straight, on minute papillae separated from each other."

St. Thomas, Aug.; Toronto, Dec.; Entomological Branch, Ottawa.

Xenylla pseudomaritima n. sp.

(Pl. III, fig. 3-10)

Grey, mottled with blue pigment; a dark median dorsal patch on the head, behind the eyes. Eyes 5+5. Antennae shorter than head. Antennal segment III with sense organs as shown in fig. 3, plate III. Ant. IV with at least 4 olfactory hairs and a pair of bulbous terminal sensillae. Unguis finely tuberculate, slightly curving, unidentate one-third from apex. Two clavate tenent hairs before each claw. Inferior claw absent. Dens and mucro confluent. Manubrium sub-equal to mucrodens, and with a ventral median cleft. Mucro terminating in a blunt hook, bearing a narrow lateral lamella. Dens finely tuberculate, with one dorsal and one lateral bristle. A pair of short anal spines, one-quarter the length of the hind unguis, on broad separated papillae. The spines are sub-equal in length to their papillae.

This species approaches *X. maritima* of Tullberg, but differs from the latter in the form of the mucrodens, and the tuberculate dens and unguis.

Chatham, July 28, 1931; taken in large numbers beneath rotting poplar bark.

KEY TO THE GENUS ACHORUTES

1. Unguis with two or three tenent hairs. 2
 Unguis with a single tenent hair. 3
2. Anal spines less than one-fourth as long as hind unguis. Mucro one-fourth to one-fifth as long as dens. *macgillivrayi* Fols.
 Anal spines one-half as long as hind unguis. Mucro one-third as long as dens. *humi* Fols.
3. Dentes with several large dorsal teeth. 4
 Dentes without dorsal teeth. 5

4. Body with dorsal serrate and capitate setae. Max. length 1 mm. *nothus* Macn.
 Body without capitate setae. *socialis* Uzel.
5. Anal spines one-quarter to one-third as long as hind unguis. Mucro
 one-third as long as dens. *pannosus* Macn.
 Anal spines sub-equal to hind unguis. 6
6. Mucro one-quarter as long as dens. 7
 Mucro two-fifths to one-half as long as dens. 8
7. Dorsal capitate setae present, unguis untoothed. *packardi* Fols.
 Dorsal capitate setae absent, unguis unidentate.
packardi var. *dentatus* Fols.
8. Eversible sac between Ant. III and IV. Mucro half as long as dens.
armatus Nic.
 Eversible sac absent. Mucro two-fifths as long as dens.
guthriei Fols.
- Achorutes macgillivrayi* Fols.

This species was taken in great numbers at Niagara Glen from fallen leaves. Over 300 were estimated upon a single elm leaf. Minor variations from the original description apply mainly to the mucro. The mucro of the Niagara form is slightly less than one-quarter of the dens in length. The tubercles of the postantennal organs are four, situated midway between the reniform eye-patch and the base of the antenna. In the Crieff Hill specimens the mucro is one-fifth as long as the dens. The antennae are somewhat atypical in respect to segmental ratios. Anal spines are equal in length to the basal lamella of the inferior claw. Unguis unidentate one-half from base, instead of one-third. Specimens from both localities are buff-coloured.

Crieff Hills, Nov. 27, 1930; under maple bark at the base of the tree.

Niagara Glen, Nov. 15, 1931; upon fallen wet leaves with *Onychiurus armatus*, and *Dicyrtoma unicolor*.

Achorutes humi Fols.

Specimens conform almost typically to Folsom's description. In Toronto specimens the pale pigment occurs on a yellow ground colour. The tubercles of the postantennal organ are not exactly sub-equal in our form. The unguis is unidentate one-fourth from the apex.

Toronto, April 18, 1931; in humus.

Achorutes nothus Macn.

Mr. Macnamara found this species on snow, from November to March, 1920, and in moss in April, at Arnprior, Ont. According to

him and to Dr. Folsom, this snow species, although closely allied structurally to *A. socialis* Uzel., differs from the latter in the type of clothing, and in the form of the teeth on the dentes. It is also much smaller.

Achorutes socialis Uzel.

This typical snow species was observed swarming over a trail in the vicinity of Pottageville, Ont. (Kelly Lakes) during March. In the depressions in the snow, where the insects had been trapped, they could be gathered in hundreds. Beneath the hemlocks, they covered the snow with a frequency of over 400 to the square foot, but this number decreased in the more open spaces near the edge of the bush. *A. socialis* is, of course, synonymous with *A. nivicola* Fitch.

Pottageville, March 21, 1931.

Achorutes pannosus Macn.

This species was described by Mr. Macnamara from specimens sent to him from Monteith, Ont. There, they were discovered infesting a lawn. Besides the description of this species the author notes, "*Achorutes pannosus* comes close to *A. maturus* Fols., but differs in the presence of large dorsal tubercles on the dentes, broader base of unguiculus, longer anal spines, and in the shape of the mucro, as well as some other minor differences. The species also approaches the European *A. manubrialis* Tullb., but is separated from the latter principally by differences in the mucrones, unguiculus and post-antennal organ."

Belleville, May 17, 1931; collected under loose limestone, on the banks of the Moira River.

Achorutes packardi Fols.

Kettleby, Oct. 15, 1930; found in an ant-hill.

Toronto, Mar. 21, 1931; specimens were very plentiful under elm bark, associated with *Entomobrya multifasciata* Tullb.

Toronto, June 26, R. J. Crew.

De Grassi Point, Sept. 1, 1915, E. M. Walker.

Achorutes packardi var. *dentatus* Fols.

This seasonal variety was found under maple and elm bark in large numbers during the late summer at Rondeau Park.

Pottageville, Nov. 11, Nov. 13, common under bark of tamarack; March 21, 1931, under elm bark.

Toronto, (High Park), Mar. 14, 1931, April 12, 1931, under bark of *Betula papyrifera* and *Crataegus* sp.

Rondeau Park, Aug. 3, 1931; extremely common under elm and maple bark.

Achorutes armatus Nic.

The Rondeau Park form agrees closely to Folsom's re-description. Dorsally, the body is greenish grey, becoming yellow ventrally. No "Nebenhocker" is present near the eye-patch. There is a tendency for the tenent hairs to be feebly knobbed in some individuals.

Pottageville, April 3, 1931.

Rondeau Park, Oct. 4, 1931; in leaf mould.

De Grassi Point, Sept. 1, 1915, E. M. Walker.

Achorutes guthriei Fols.

Ontario specimens are somewhat atypical in respect to the type of clothing, the dorsal body setae being much longer. The ground colour is grey, strongly mottled with blue on the head, legs and furcula. The littoral habitat of this species in Ontario supports Guthrie's observations.

Port Hope, July 5, 1931; common under wet stones on the beach.

Kingston, Aug. 29, 1931; taken with *Anurida tullbergi* under loose limestone strata on the shore of Lake Ontario.

Achorutes (Schöttella) glasgowi Fols.

One specimen only was secured at Chatham, under rotting corn stubble, on July 22, 1931. This may be the second American record.

Subfamily Neanurinae

1. Supra-anal valve round. Anal segment small. Segmental tubercles absent. Furcula present or absent.

Tribe *Pseudachorutini* Börn.

2. Supra-anal valve bilobed. Anal segment large. Furcula absent.

Tribe *Neanurini* Börn.

Tribe Pseudachorutini

Synopsis of Genera (after Folsom)

1. Furcula present..... 2
 Furcula absent..... 3
2. Anal spines absent. Eyes 8+8. Postantennal organ present.
 Pseudachorutes Tullb.
 Anal spines present. Eyes usually 8+8, sometimes 5+5. Post-
 antennal organ absent. *Friesia*, Dalle Torre.
3. Eyes 5+5 or none. Mouth parts not projecting in a cone.
 Anurida, Laboulb.

Eyes 2+2 or 3+3 or none. Mouth parts projecting in a cone.

Paranura Axel.

Pseudachorutes saxatilis Macn.

P. saxatilis has been separated from *P. lunatus* as follows: Post-antennal organ with 25-29 tubercles, antennae sub-equal to head, mucro one-third as long as dentes. Maximum length 1.5 mm.

Mr. Macnamara secured this new form on the banks of the Ottawa River at Marshall's Bay, from August to October.

Pseudachorutes lunatus Fols.

Postantennal organ with only 10-12 tubercles, arranged in an oval. The antennae are shorter than the head. Mucro two-fifths as long as dentes. Our form agrees essentially with the cotypes according to Dr. Folsom, but lacks knobbed tenent hairs on the tibiotarsi.

Several specimens were taken in the wet woody layers of a decaying log, at swamp levels, Rondeau Park, Oct. 3, 1931.

Friesea sublimis Macn.

This interesting form which perhaps is the only native species in America (excluding Guthrie's as exotic), was repeatedly collected by Mr. Macnamara from the top bark of maple trees. Arnprior, April and October.

Anurida tullbergi Schött

Ground colour yellow, with dark blue pigment. Eyes 5+5. Post-antennal organs with 30 peripheral tubercles, arranged in an ellipse. The unguis is either weakly unidentate or without teeth. Antennae shorter than the head. Length 3.1 mm.

Erieau, July 25, 1931; beneath shore debris on Lake Erie.

Port Hope, July 5, 1931; on the beach of Lake Ontario, under wet stones, associated with *A. guthriei*.

Kingston, Aug. 29, 1931; under loose limestone on the shore of Lake Ontario.

Anurida granaria Nic.

White. Eyes absent. Postantennal organ consisting of about 16 tubercles, arranged in a rosette. This form is yellowish dorsally, but otherwise agrees closely with Guthrie's description of his Minnesota form.

Kingston, Aug. 29, 1931; under limestone on the shore of Lake Ontario, with *Anurida tullbergi* and *Achorutes guthriei*.

Paranura sexpunctata Axel.

Yellow, mottled with dark blue pigment. Agrees almost typically with Axelson's figures for this species. Only three large adults were secured. Eyes, 2+2, anteriorly in the eye-patch; 1+1, isolated much further back. Antennae shorter than the head. Inferior claw absent, tenent hairs absent. Cuticle evenly tuberculate.

This is apparently the first American record for the species.

Rondeau Park, Oct. 4, 1931; taken from leaf mould in Pine woods.

Tribe Neanurini

At present, the Tribe is represented in our fauna by two species of *Neanura*.

Neanura muscorum Temp.

Of the two, this is the commoner, and the one most frequently found in rotting wood. The eyes are reduced to three on each eye-patch. The adults are dark blue but, in the immature stages, are usually paler.

Niagara Glen, Nov. 10, 1930; beneath rotting elm bark.

Chatham, July 17, 21, 24, 1931; very common in wet corn stubble; July 28, 1931; under poplar bark with *Xenylla pseudomaritima*.

Erieau, July 25, 1931; on the shore of Lake Erie, under wood.

Toronto, March 14, 1931; under birch bark; April 4, in a cedar stump; Nov. 25, young individuals, about two weeks old, found in a damp log.

De Grassi Point, Aug. 15, 1915, E. M. Walker.

Orillia, Nov. 13, 1931; in decaying wood, S. Brennan.

Neanura barberi Hands.

Entirely white. Antennae shorter than the head. Eyes, 2+2. The characters of our form apply closely to those given by Guthrie, to *N. quadrioculata*, the name of which, was preoccupied by Börner (1901).

Rondeau Park, Oct. 3, 1931. Mature individuals were very common in the spongy, wet wood of an old log, at swamp levels, and were associated with *Pseudachorutes lunatus* Fols.

FAMILY ENTOMOBRYIDAE Töms

*Subfam. Isotominiæ**Synopsis of Genera*

| | |
|----------------------|-------------------------|
| 1. Furcula absent. | <i>Anurophorus</i> Nic. |
| Furcula present..... | 2 |

2. Furcula attaining ventral tube, Abd. IV as long as, or sub-equal to Abd. III. *Isotoma* Bourl.
 Furcula not attaining ventral tube. 3
 3. Abd. IV-VI, fused. *Folsomia* Willem
 Abd. IV and V, distinct; V and VI, sometimes fused. *Proisotoma* Börn.

Anurophorus laricis Nic.

Head, antennae and body pale grey, interrupted dorsally by lighter spots and patches, and at intersegmental areas. The spots and other markings correspond closely to those figured by Willem (1900). Furcula absent. Postantennal organ, elliptical, situated laterally from the antennal foveae. Eyes, 8+8 (unequal), on a black patch. Antennae sub-equal in length to the head. Unguis untoothed, curving. Inferior claw reduced to a spine. At the base of each claw are three strongly clavate tenent hairs. Cuticle finely granulated. Length, 1.5 mm.

Chatham, July 22, 1931; under decaying corn stubble.

Genus Isotoma Bourl.

Members of this large genus, both species and varieties, range widely, and vary considerably in pigmentation. Specific separation, depends mostly upon the form and dentition of the mucro, and the characters of the claws.

KEY TO SPECIES OF ISOTOMA

1. Tibiotarsi with strongly clavate tenent hairs. *I. (Vertagopus) cinerea* Nic.
 Tibiotarsal hairs, if present, only feebly clavate. 2
 2. Mucro bidentate, dentes coarsely tuberculate. *muskegis* Guth.
 Mucro with three or more teeth, dentes evenly chitinated. 3
 3. Mucro tridentate. 4
 Mucro with four or more teeth. 6
 4. Apical tooth of mucro, no longer than ante-apical, almost vertical. *viridis* Bourl.
 Apical tooth of mucro, longer than the ante-apical, sub-horizontal. . 5
 5. Mottled grey, apical tooth twice as long as ante-apical. *sensibilis* Tullb.
 Yellow, apical tooth sub-equal to ante-apical. *leonina* Pack.
 6. Dens with a double row of stout spines. *multispinata* n. sp.
 Dens without spines. 7
 7. Apical tooth of the mucro, at the base of the second. 9
 Apical tooth, not at the base of the second. 8

8. Apical tooth of mucro distinctly hooked; postantennal organ as long as twice the diameter of a single eye. *olivacea* Tullb.
Apical tooth sub-horizontal; postantennal organ as long as a single eye diameter. *nigra* Macg.
9. Mucro with five teeth; head as long as the first three body segments. *grandiceps* Reut.
Mucro quadridentate; head sub-equal in length to mesothorax. *palustris* Mull.

Isotoma (Vertagopus) cinerea Nic.

Head and body dark purple, except ventrally; antennae, basal joints of the legs, and manubrium, paler. Remainder of furcula and tibiotarsi, yellowish white. U-shaped marking on the head, between the eyes. Intersegmental areas a pale yellow, especially on the first four body segments. Eyes 8+8 (unequal), on a black patch. Postantennal organ narrowly elliptical. Unguis with an outer tooth one-third from base, and a double inner tooth, one-third from apex. Inner tooth of unguis sharply defined. Pro-ungues with a pair of feebly clavate tenent hairs; meso- and meta-ungues, with three strongly clavate tenent hairs. Mucro quadridentate. Apical tooth sub-horizontal, the second longer than the first and almost vertical; the third, vertical, shorter than the second; the fourth short, blunt, close behind the third, but lateral in position. Length 1.6 mm.

Pottageville, April 3, 1931; under bark of *Pinus strobus*.

Toronto, April 4, 1931; under bark.

Isotoma muskegis Guth.

This interesting and apparently dimorphic Collembolan, was described by Guthrie from Minnesota in 1903. Specimens collected by Dr. E. M. Walker, constitute, I believe, the second record of the species. Judging from Guthrie's description, our specimens are all females, although they possess one or two short spines on the postero-lateral margin of abdominal segments I, II, and III. The tenent hairs also are feebly clavate. Otherwise in respect to the mucro and the claws, they agree essentially with the original description.

De Grassi Point, L. Simcoe, E. M. Walker, Aug. 9, 1909.

Isotoma viridis Bourl.

Isotoma viridis is a large species which varies a great deal in pigmentation. Specimens from Belleville and Toronto are purplish gray, with distinctly purple antennae, and a black marking on the head behind the eyes. The legs too, are purplish, but the furcula is white. The

unguis bears two inner teeth and one outer tooth; the inferior claw is unidentate. Length 4 mm.

Belleville, May 18, 1931, Dominion Parasite Laboratory greenhouse; common in the strawberry beds, and under flower pots; May 19, 1931, found on the banks of the Moira River, on algae-covered limestone.

Napanee, May 24, 1931; in colonies under limestone flags, on the river bank.

Toronto (Don V.), May 24, 1931; under wood on a creek bank.

Isotoma sensibilis Tullb.

Colour mottled grey, giving the impression of sprinkled pepper. Three narrow, more or less transverse bands on the head, behind the eyes. Eyes 8+8 on dark patches. Antennae longer than head, 17:11, with segments in the following ratios: 4, 7, 6, 11. Claws without teeth, or with one minute, outer tooth on the unguis one-third from its base. Tibiotarsi of front legs with one simple tenent hair; meso. and meta. tibiotarsi, each with feebly clavate tenent hairs. Mucro tridentate. Apical tooth, sub-horizontal and hooked; second and third sub-equal, one behind the other. Clothing of numerous short hairs, progressively longer on Abd. V and VI. Length 1.2 mm.

Credit Forks, Oct. 26, 1931; in moss and liverworts (Lunularia).

Toronto, April 5, 1931; under birch bark.

Pottageville, May 11, 1931.

Chatham, July 27, 1931; common in rotting corn stubble.

Rondeau Park, Oct. 2, 1931; taken from leaf mould. These specimens show no apparent structural variation from the Pottageville examples.

Isotoma leonina Pack.

This is a fairly common bark-inhabiting species around Toronto, and can be readily identified under the microscope by its elongate form and long black eye-patches, which are sharply contrasted against the yellow ground colour.

Toronto, Oct. 26, 1930, under bark; Oct. 18, 1931, under the rotting bark of *Betula papyrifera*.

Pottageville, Mar. 11, 1931; found under hemlock bark.

Chatham, July 28, 1931; beneath poplar bark of a fallen tree.

Rondeau Park, Aug. 3, 1931; common under rotting bark.

Isotoma multispinata n. sp.

(Plate I, fig. 1-8)

Colour, mainly dark green, including the antennae, manubrium, coxal and pre-coxal segments of the legs. Remainder of the legs and

furcula yellowish white. Yellow, narrow, intersegmental bands present, extending ventrally to the paler sternal region. *Antennae* one and one-half times as long as the head. Segmental ratios: 3, 11, 10, 14. Fourth segment of antenna tapering sharply near its apex. *Eyes*, eight on each side of the head, unequal. Postantennal organ elliptical, equal in length to the diameter of the nearest eye. Abd. III sub-equal in length to Abd. IV. *Unguis* slightly curving, bearing an outer tooth one-third from its base and an inner one midway between base and apex. *Inferior claw* one-half as long as the unguis, basal half sub-rectangular with the suggestion of an inner tooth; distally acuminate. Tibiotarsi with a simple, tapering, non-clavate tenent hair. *Furcula* attaining ventral tube. *Dentes* twice as long as the manubrium. Manubrium with two pairs of dorsal, short, stout spines, near the median cleft. Proximal half of dens straight, with a double row of 4-5 dorsal spines, resembling those on the manubrium, but increasing in length distally. Distal half of dens curving. Mucro quadridentate. Apical tooth the longest, hooked; ante-apical, shorter and erect; third sub-erect, almost behind the second tooth; fourth tooth blunt, short, and lateral in position. Tenaculum quadridenticulate. *Clothing* of short simple setae on the head and body, with progressively longer setae posteriorly on the abdomen, some of which on Abd. V, are feathered on one side only. Length, 1.5 mm.

This interesting form is distinguished at present from all other American *Isotomas*, by the possession of a spinous dens. The latter character is so well developed that one expected to find generic differences as well. This is not the case however, since other characters are the ones normally belonging to the genus.

This new species was found in leaf mould, at swamp levels, in Rondeau Park, Oct. 2, 1931.

Isotoma olivacea Tullb.

In the aceto-alcohol fixative, the specimens are yellowish brown; in respect to the dentition of the mucro, they approach closely to the re-description of Axelson's principal form.

Pottageville, May 11, 1931; in humus.

Isotoma nigra Macg.

Black to the naked eye, but appearing dark green under a compound lens. Body, head and antennae dark green, with paler intersegmental areas, dorsally between the body segments. Paler specimens sometimes with a thin median line dorsally, running from the first thoracic to the fifth abdominal segment. Posterior region of the head

pale green. Legs and furcula pale green. Unguis with an outer tooth half way from apex and an inner one one-third from the apex. Inferior claw sub-rectangular at its base, with a minute inner tooth; distally acuminate. Mucro quadridentate. The first tooth sub-horizontal and equal to the second. Third and fourth short, sub-equal, and almost opposite. Eyes 8+8. Postantennal organ an oval ellipse, equal to the diameter of a single eye. Setae on Abd. V and VI, simple.

Toronto, April 4, 1931; common under cedar bark in a swamp; Oct. 18, in moss and under cedar bark; March 18, in moss.

Niagara Glen, Nov. 15, 1931.

Pottageville, Nov. 1, 1931; under bark.

Grimsby, Nov. 10, 1930; found in mould.

Isotoma grandiceps Reut.

One specimen only was collected from leaf mould, at Crieff Hills, Ont., and was first determined to be *I. macnamarai* Fols., although obviously closely allied to the European form cited above. However, Mr. Macnamara reports that the species was separated from the European form on the basis of defects in Reuter's description. This synonymy will appear in a forthcoming paper by Dr. Folsom.

This snow species was observed by Mr. Macnamara to be carnivorous on other Collembola, including the common snow-flea, *Achorutes socialis*.

Crieff Hills, Nov. 27, 1930; in leaf mould.

Isotoma palustris (forma *principalis*) Müll.

The principal form of *I. palustris* differs strongly from the other colour varieties. The median dorsal stripe is sharply outlined on a pale yellow ground colour. In addition, there is a dark lateral band on each side of the thorax and abdomen.

Pottageville, April 3, 1931; on the surface of pond water, also in sphagnum moss.

Toronto (High Park), April 5, 1931; common on pond edges and on shore debris.

Var. *prasina* Reut.

Prevailing body colour olive green, pale in some individuals but darker in others. It is only in the well pigmented specimens that the black, median dorsal line is obscure; otherwise, it is a good character for the ready determination of this variety in the field.

Toronto, Nov. 2, 1931; on pools of the Humber River.

Elora, Oct. 12, 1931; on moss covering limestone.

Erieau, July 25, 1931; on the shore of Lake Erie under pieces of wood.

Var. fucicola Reut.

Violet, with paler intersegmental bands. A more or less obscure median line runs along the dorsum of the insect, and is represented on the head by a much wider spot. The dark eye-patches, are contrasted by adjacent pale yellow pigment. Antennae and leg bases, violet; furcula and distal joints of the legs, yellowish white. Length, 1.8 mm.

Toronto, April 18, 1931; taken under cedar bark.

Pottageville, May 11, 1931.

Var. balteata Reut.

This variety was very common in the greenhouse of the Dominion Parasite Laboratory at Belleville, but is possibly exotic. Ground colour a variable greenish yellow. Body with dark green bands, covering the anterior half of thoracic segments II and III, and the first three segments of the abdomen. Anterior two-thirds of Abd. IV and V, dark green. Eyes on a black patch, joined anteriorly by an anchor-shaped band of pigment. A similar marking lies on the head behind the eyes. Length, 2 mm.

Belleville, Sept. 20, 1931; in moss; April 9, 1932; in strawberry beds and under flower pots.

Folsomia elongata Macg.

*This is undoubtedly closely allied to the form which Guthrie described from Minnesota as *Folsomia bidenticula*. Owing to the inadequate description by MacGillivray, Guthrie described it as a new species. Since then, Dr. Folsom has studied MacGillivray's types from Colorado and adjusted the error.

The postantennal organ of the Toronto form is constricted in the middle, differing somewhat from Guthrie's figure. All Axelson's species of *Folsomia* have a reduced number of eyes, but in this case, 8+8 persist. Length, 1.2 mm.

Toronto (High Park), May 14, 1931; under bark of paper birch.

Proisotoma minuta Tullb.

White. Head and body covered uniformly with short hairs. Antennae longer than the head, with segmental ratios as follows: 5, 8, 7, 5, 13. Eyes, 8+8 on an irregular black patch. Postantennal organ elliptical, slightly constricted. Both claws without teeth. Inferior claw slightly expanded basally, and about one-half as long as the unguis. A single tenent hair is present on the tibiotarsus. Abdominal segments IV and V. More or less fused. Abd. IV longer than Abd. III. Furcula

not attaining ventral tube. Manubrium, longer than the dentes, (11:10). Mucro tridentate. Apical tooth horizontal; the second, vertical, and sub-equal to the first; the third shortest, situated laterally, some distance back from the second. Length, 1.3 mm.

Belleville, Aug. 21, 1931; in garden soil, about the roots of Rumex. Erieau, July 25, 1931.

Proisotoma ewingi Fols.

Dark purple, with a mottled appearance on the head and body. Legs and furcula partly pigmented. Abd. V and VI, unfused. Abdomen IV longer than III (22:17). Antennae, sub-equal to head with joints in ratios as follows: 2, 3, 3, 5. Eyes 8+8 on a black patch. Post-antennal organ elliptical, as long as two eye diameters. Both claws unarmed. One feebly developed tenent hair present on the tibio-tarsus. Furcula not attaining the ventral tube. Manubrium slightly longer than dentes. Dens twice as long as mucro. Mucro with two teeth, the first sub-horizontal, at the base of the second; the second, erect, conical, longer than the first. Length, 1.2 mm.

Dr. Folsom has described this species from material collected at Vicksburg, Mississippi.

Belleville, May 21, 1931. Found in moss. Apparently, this is the second record.

Proisotoma similis n. sp.

(Plate II, fig. 6-8; Plate III, fig. 1 and 2)

Pigmentation: ground colour pale grey, with black spots and markings, giving the insect a mottled grey appearance. Furcula and legs yellowish. *Antennae* sub-equal to the head diagonal, with segmental ratios as follows: 7, 11, 13, 21. Sense organs on antennal segment III, with two curving sense rods. *Eyes* five on each side of the head, equal, on an irregular black patch. Post antennal organ narrowly elliptical, slightly constricted (fig. 1, pl. III), and equal in length to three times the diameter of one eye. Abdominal segments V and VI fused. *Claws* unarmed. Unguis twice as long as the inferior claw. Unguiculus basally sub-rectangular, distally acuminate. Tibiotarsus with a pair of simple tenent hairs. *Furcula* not reaching the ventral tube. Dentes one and one-half times as long as the manubrium. Mucro bidentate; apical tooth the longest, sub-horizontal; ante-apical, conical, erect. *Clothing* of moderately short, curving setae on the head and body, with longer setae on Abd. V and VI, and on the furcula. Length, .9 mm.

This form is allied to Axelson's Finland species, *Proisotoma (Isotomina) thermophila*, especially in respect to the mucro dentition. The

latter, however, has the normal number of eyes (8+8), and also diverges in the characters of the claws.

Belleville, May 18, 1931. This new species was taken in moss on the rock ledges of the Moira River.

Subfam. Tomocerinae

Genus Tomocerus Nic.

Members of this scaled genus, because of their large size and agility, are the most conspicuous springtails of the humus. The Ontario species are three in number, including three varieties. In this genus the most satisfactory characters for separating species and varieties are found on the dens. The latter is divided into three segments, the first two segments bearing a row of dorsal spines. The arrangement of these spines, is usually indicated by simple formulae. For example, 2/4, 2 indicates that a suture divides the spines on the proximal segment from those on the following joint. The larger spines are indicated by bold faced type.

Tomocerus vulgaris Tullb.

Dental spines simple. General formula of dens: 4-6, **I**/2-5, **I**, 1-2, **I**. Colour dark purple to black, but dusky yellow when denuded of scales. Specimens can be roughly identified in the field by the large tuft of setae, anterior to the mesonotal collar, and the brown tibiae. Unguis with 4-6 inner teeth. Inferior claw unarmed.

Belleville, June 17, 1931; under boards. 5-6, **I**/3-4, **I**, 1, **I**.

Kingston, Aug. 30, 1931; under river bank debris. 6, **I**/4, **I**, 2, **I**.

Ottawa, Sept. 2, 1931; under driftwood on the banks of the Ottawa River. 4, **I**/4, **I**, 2, **I**.

Toronto, Oct. 21, 1931; in humus. 4, **I**/4-5, **I**, 2, **I**.

De Grassi Point, July 15, 1931. 5, **I**/5, **I**, 2, **I**. E. M. Walker.

Tomocerus minor Lubb.

Although smaller than *T. vulgaris*, it has much the same lead colour when the scales are present. The spines, which are always tridentate, readily separate it from the other American species. General formula: 4-6/2-5, **I**, 1-2, **I**. Unguis with five teeth; unguiculus unarmed in Toronto specimens, but bearing a minute outer tooth in the Ottawa forms. Individuals of this species were usually taken from more moist habitats than those of *T. vulgaris*. In Massachusetts Dr. Folsom found this common European species only in greenhouses.

Toronto (Don Valley), Oct. 25, Nov. 8, Dec. 23, 1930. Very common under fallen wood and damp leaves near a stream. Formula: 3/4, **I**, 1-2, **I**.

Credit Forks, Oct. 26, 1930; on cedar bark.

Napanee, May 24, 1931; under willow bark. 4/5, I, 2, I.

Ottawa, Sept. 7, 1931; under boards. 4/3-4, I, 1, I.

Tomocerus flavescens Tullb. (typical form)

The bright yellow colour of the species separates it from the former two. The typical form is recorded by Dr. Folsom to be widely distributed but rare in North America. The unguis is bidentate.

Toronto, April 19, 1914, E. M. Walker.

Var. *separatus* Fols.

The distinguishing character of this variety is the large proximal spine in the series. Unguis with three inner teeth, often with the suggestion of a fourth. Inferior claw unidentate.

De Grassi Point, Aug. 8, 1915, E. M. Walker.

Rondeau Park, Oct. 2, 1931; in humus at swamp levels.

Chatham, Aug. 8, 1931; in leaf mould with *T. flavescens* var. *americanus*.

Belleville, July 7, 1931; under stones and in moss, on the banks of the Moira River.

Kingston, Aug. 30, 1931; under shore debris of Cataraqui River.

Ottawa, Sept. 7, 1931; found in moss. (I/7, 2).

Var. *americanus* Schött.

Dentes with two large proximal spines. General formula, 2/5-7, 2. Unguis with three teeth and a minute fourth. Tooth on inferior claw present or absent.

Crieff Hills, Nov. 21, 1931, C. Copeland; in leaf mould.

Rondeau Park, Oct. 2, 1931; under rotting bark.

Toronto, April 5, 1931; under oak bark; Oct. 21, 1931; in leaf mould. (2/6, 2).

Weston, Sept. 28, 1931; under stones on the banks of the Humber River.

De Grassi Point, July 15, 1915, E. M. Walker.

Var. *arcticus* Schött.

Proximal spines absent; spines increasing in length distally, the last two sometimes sub-equal. Unguis quadridentate. Inferior claw with a minute inner tooth. Dental formula of Ottawa specimens, 0/5-6, 2.

De Grassi Point, May 5, 1915, E. M. Walker.

Ottawa, Sept. 7, 1931; taken in leaf mould.

Subfam. Entomobryinae: Synopsis of Genera

1. Antennae with five to six segments. 2
 Antennae four-jointed. 3
2. Scales present; pigment mostly absent; antennae five-jointed. *Heteromurus* Wankel
 Scales absent, body hairy; strongly pigmented; antennae composed of six segments. *Orchesella* Templ.
3. Scales absent. *Entomobrya* Rond.
 Scales present. 4
4. Mesonotum projecting over the head. *Lepidocyrtus* Bourl.
 Mesonotum not distinctly projecting over the head. *Sira* Lubbock.

Heteromurus nitidus Templ.

This species was common beneath boards at the Lab. greenhouse at Belleville. Although white to the naked eye, specimens fixed in alcohol, bear the rust-coloured spots observed by Lubbock. The unguis bears an inner tooth one-third from its base, while the inferior claw is unidentate, one-third from its apex on the outer edge. Length 3 mm.

Belleville, May 18, 1931; found under boards with *T. vulgaris*.

Kingston, Aug. 29, 1931; under shore drift-wood on Cataraqui R.

Toronto, Oct. 12, 1930.

Orchesella hexfasciata Harv.

Yellow with black bands. The suture between antennal segments II and III, is very obscure in this species, which accounts for the fact that Harvey mistook it for an *Entomobrya*. The insect is named from the six transverse black bands, including the one on the mesonotum.

Pottageville, Nov. 1, 1931; under hemlock bark.

Toronto, April 18, 1931; in moss.

Rondeau Park, Oct. 2, 1931; under logs and in moss (the pigmentation does not vary from that of the Toronto form).

De Grassi Point, July 7, 1915, E. M. Walker.

Orchesella folsomi Maynard.*

In this striking *Orchesella* the head and the first two segments of the thorax as well as their appendages are yellow. The remainder of the insect, with the exception of the furcula, is blue-black. Even the

*Mr. E. A. Maynard has kindly sent me the following preliminary description of this new species. A complete description will appear in a forthcoming issue of the Bulletin of the Brooklyn Entomological Society.

Orchesella folsomi (Maynard) n. sp.

Length 1.8 mm. Colour pale yellow and blackish purple. Head, prothorax, and mesothorax entirely yellow except for the black eye spots. Metathorax and abdomen entirely dark purple except for the yellow furcula. Antenna I purple dorsally, yellow laterally and ventrally; antenna II yellow except for purple band on apical one-sixth; antenna III entirely yellow; antenna IV yellow with purple band on apical one-third; antenna V purple except for narrow yellow ring at base; antenna VI entirely purple. First two pairs of legs yellow except for a mere trace of purple pigment on tibiotarsi. Third pair of legs purplish throughout.

ventral tube is black. Specimens were common in moss at Niagara Glen.

Four individuals from the same locality are somewhat transitional in respect to pigmentation. Each of the latter has a transverse band across the metanotum, behind which the abdomen is only irregularly pigmented. The pigment on the last two abdominal segments is confined to narrow, lateral bands, leaving a yellow median dorsal area. Fore legs yellow; middle and hind legs purplish distally. Ventral tube yellow.

Niagara Glen, Nov. 10, 1930; under the rotting bark of an old log.

Niagara Glen, Nov. 14, 1931; common in moss (*Polytrichum*), and under the loose bark of old stumps.

Orchesella ainsliei Fols.

The species superficially resembles *O. zebra* of Guthrie (1903). Dr. Folsom's colour description is as follows: "Yellow or brownish yellow, marked with dark blue becoming blackish where dense. Body with four conspicuous stripes, two dorsal and two lateral, interrupted intersegmentally, extending from prothorax as far as Abd. II, the lateral stripe continued weakly across the head to the eye spot. Last five abdominal segments mostly blackish dorsally and laterally, but with irregular intersegmental bands of brownish yellow. Sternum yellow."

Ontario specimens agree closely both in pigmentation, as well as claw and mucro dentition.

Belleville, June 17, 1931; taken from moss on the limestone ledges of the Moira River; June 21, 1931; common in moss in meadow.

Ottawa, Sept. 7, 1931; in moss and humus. (Distal rings of pigment on the antennae less marked than in the Chatham form.)

Chatham, Aug. 8, 1931; in moss. (Pigment on mesonotum reduced.)

Weston, Sept. 28, 1931; in moss.

Pottageville, Oct. 18, 1930.

Point Pelee, Aug. 3, 1931.

Genus *Entomobrya* Rond.

The separation of species in this genus has always been a problem because of the generalized form of the mucro and claws. Specific differences are based mostly upon pigmentation design. Accordingly, upon this basis also, the following key to the Ontario species is outlined.

KEY TO SPECIES OF ENTOMOBRYA

1. Pigment more or less uniformly distributed over the body 2
- Bands or spots of dark pigment overlying a paler ground colour on the body 4

2. Body totally yellow. *flava* Lie-Peterson.
Colour not yellow. 3
3. Black line joining the bases of the antennae to the eye-patches; Abd. III one-half as long as Abd. IV. *griseo-olivata* Pack.
No black line joining the antennal bases; Abd. III one-quarter to one-third as long as Abd. IV. *purpurascens* Pack.
4. Metanotum and abdominal note I and II, dark blue. *clitellaria* Guth.
Metanotum and first two abdominal nota not completely pigmented. 5
5. Head and body with ten transverse black bands, including the line joining the eye patches; Abd. IV with two distinct bands. *multifasciata* Tullb.
Head and body with less than ten transverse bands; Abd. IV without two distinct bands. 6
6. Thorax and abdomen with five transverse bands, those upon Abd. I, III, and IV, irregularly broken. *assula* Fols.
Body with only three transverse bands. *ontarionensis* n. sp.

Entomobrya flava Lie-Peterson

Head, thorax, first two abdominal segments, legs and furcula light yellow. Remaining abdominal segments golden yellow dorsally. Two distal segments of the antennae dusky. Median spot in front of the eyes joined by a black band to the latter. Abd. IV five to six times as long as Abd. III.

In the absence of a more complete series individuals approach closely to the above named species, especially in respect to the relative lengths of the third and fourth abdominal segments. Other characters follow the description as far as it goes.

Elora, Oct. 10, 1931; common under the bark of paper birch.

Entomobrya griseo-olivata Pack.

Pale olive. Head pale with a narrow black band joining the eye-patches anteriorly. Antennae purplish, segments II, III, and IV subequal; II twice as long as one. Antennae more than one-third as long as the body. Pleural edges of thoracic segments I and II rimmed with black pigment. Abd. IV four to four and one-half times as long as Abd. III. Furcula white; legs yellowish with traces of blue pigment on the tibio-tarsi. Length 1.7 mm.

Kingston, Aug. 30, 1931; under shore drift on the Cataraqui River.

Entomobrya purpurascens Pack.

This is a very common purplish species that is found in a variety of

habitats. The antennae are dark purple and equal to four-fifths of the body length. Segmental ratios as follows: 2, 3, 3, 4. Only a median triangular spot exists between the bases of the antennae; in some of the smaller individuals, a fine, arcuate line joins the eye-patches.

Belleville, Aug. 18, 1931; found in all stages in the axils of sweet corn leaves, and on the outer sheath leaves of the cobs. Pottageville, April 3, 1931; under loose pine bark of a fallen tree. Ottawa, Sept. 7, 1931; common in shore debris on the banks of the Ottawa River with *Tomocerus vulgaris*. Rondeau Park, Oct. 2, 1931; in moss.

Entomobrya clitellaria Guth.

Specimens from Rondeau Park agree essentially with Guthrie's description of his Minnesota species. In our specimens the lateral band on the mesonotum is strongly defined. On each side of the head is a large postero-lateral spot. The hind femora and the ventral surfaces of Abd. III and Abd. IV are bluish. The most striking character, is the dark blue, saddle-shaped band of pigment, extending solidly from the metanotum to the third abdominal segment. The ground colour is brownish yellow. Abd. IV is about five times as long as III.

Common beneath maple and elm bark, Rondeau Park, Oct. 2, 1931.

Entomobrya multifasciata Tullb.

The ground colour of this species varies from yellow to olive. Each body segment bears a dorsal transverse band of black pigment. A lateral band also extends from the anterior margin of the mesothorax to Abd. IV. The latter, is about three times as long as the third abdominal segment. In addition, a heavy line of pigment joins the eye-patches to the bases of the antennae.

This is a very common species of *Entomobrya* which feeds upon *Pleurococcus* and other algae, growing upon bark.

Toronto, Oct. 25, 1930; under maple bark; Nov. 8, 1930; upon the bark of oak and sumach; April 4, 1931; under bark of *Crataegus*; April 11, under maple, willow, white pine and yellow birch; April 12, upon the bark of *Carpinus* and elm.

Ottawa, Sept. 7, 1931; in moss.

Chatham, July 17, 1931; found in leaf mould.

Entomobrya assuta Fols.

"Dorsally yellow, banded and spotted with blue pigment, which appears black when dense; ventrally yellow. Head with a band connecting the eye-spots and the bases of the antennae. Mesonotum bordered anteriorly and laterally with more or less pigment. Metanotum

bordered narrowly with pigment posteriorly and laterally. Abd. I with or without dorsal spots. Abd. II with a broad band along the posterior margin. Abd. III with large irregular dorsal spots, the posterior margin edged with black. Abd. IV yellow anteriorly, posteriorly with four large irregular yellow spots, two dorsal and two lateral. . . . Fourth abdominal segment from three to four times as long as the third."

Variation: Specimens from Rondeau Park, have only a thin line joining the eye-patches; Abd. IV is about five times as long as Abd. III.

Rondeau Park, Oct. 2, 1931; in leaf mould.

Point Pelee, Aug. 2, 1931.

Credit Forks, Oct. 26, 1930.

Orillia, March 23, 1932; common under the bark of an apple tree.

Credit Forks, Oct. 26, 1930; in moss, and under lichen-covered birch bark.

Toronto (High Park), Mar. 21, 1931; under the bark of white pine, yellow birch and oak.

Pottageville, Mar. 22, 1931; upon the bark of paper birch and hemlock.

Ottawa, Sept. 7, 1931; found in moss.

Rondeau Park, Oct. 3, 1931; under bark.

Entomobrya ontarionensis n. sp.

(Plate IV, figs. 1-4)

Yellow, with three dorsal bands of dark blue pigment on the body. Mesonotum, bordered anteriorly with a narrow band. Posterior two-thirds of metanotum irregularly pigmented, reduced to three lines of dots in some individuals. Abd. II, with a solid band covering the posterior third of the segment and extending laterad. Abd. III has a wider arcuate band. The united pigment on Abd. II and Abd. III gives the appearance of a single dorsal band. Head with a small median patch in front of the eyes, connected by a thick line to the antennal bases. Basal segments of the antennae yellow; third and fourth segments purplish. Legs yellow. Furcula yellow, paler distally. Antennae two and one-half times as long as the head; segmental ratios: 10, 18, 15, 20. Eyes, 8+8 on a black patch. Fourth urotergite six times as long as the third. Claws: unguis almost straight bearing a pair of lateral teeth one-third from the base, and with three pairs of teeth on the inner margin; unguiculus, slender, acute, unarmed, extending two-thirds as far as the unguis. Tenent hair almost as long as unguis. Furcula attaining the ventral tube. Manubrium shorter than dens (2:3). Dorsal crenulations on the dentes ending before the apex at a distance of three mucro lengths. The mucro bears the usual apical and ante-apical teeth as well as the short spine. The head and body are clothed with clubbed

setae. Dorsal, tapering setae arising from Abd. IV are as long as the manubrium, those on Abd. V half as long. Length 1.5 mm.

Credit Forks, Oct. 26, 1930; in moss and under lichen-covered birch bark.

Toronto (High Park, Mar. 21, 1931; upon bark of paper birch; under oak and white pine bark.

Pottageville, Mar. 22, 1931; upon bark of paper birch and hemlock.

Ottawa, Sept. 7, 1931; found in moss.

Rondeau Park, Oct. 3, 1931; under elm bark.

KEY TO THE SPECIES OF LEPIDOCYRTUS

1. Ground colour yellow, with purple, grey or blue pigment.....2
 White or yellowish white almost entirely.....5
2. Yellow, with a single transverse blue band on the proximal half of
 Abd. IV; Abd. IV four times as long as Abd. III
 unifasciatus n. sp.
 Head and body uniformly pigmented.....3
3. Ant. II one-half to one-third longer than Ant. III; thorax and abdomen
 thickly scaled; deep purple. *purpureus* Lubb.
 Ant. II and III sub-equal.....4
4. Dark blue; Abd. IV three times as long as Abd. III.
 cyaneus Tullb.
 Grey or bluish grey, with paler intersegmental areas, producing a
 banded appearance; Abd. IV two and one-half times as long as
 Abd. III. *cyaneus* Tullb. var. *cinereus* Fols.
5. Eyes absent; mesonotum broad, strongly developed. *violentus* Fols.
 Eyes present.....6
6. Eyes 8+8; mesonotum strongly projecting over the head.
 albicans Reut.
 Eyes 2+2; mesonotum not projecting. *albus* Pack.

Lepidocyrtus unifasciatus n. sp.

(Plate II, fig. 1, 2, 4, 5)

Ground colour white or yellowish white. Antennae white, but sometimes with pale blue pigment on Ant. III and IV, and on II distally. Abd. IV, dorsally, with a dark blue transverse band on the anterior half of the segment. Dark spot present in front of the eyes, between the bases of the antennae. Legs and furcula white. *Head*: Eyes 8+8 on a dark patch. Antennae one and one-half times as long as the head. Ant. II twice as long as Ant. I, and greater also than Ant. III; Ant. IV, usually twice as long as III. *Mesonotum* strongly projecting over the head, more than twice as long as the metanotum. Abd. IV four times

as long as Abd. III. *Furcula* reaching the ventral tube. Dentes slightly longer than the manubrium. Mucro elongate, with a sub-horizontal, apical tooth, and a vertical ante-apical, sub-equal to the latter; close behind the second tooth, is a short spine pointing dorso-caudad. *Claws*: unguis, with two teeth one its inner margin, and a pair of proximal outer teeth situated laterally. Inferior claw two-thirds as long as the unguis, lanceolate, unarmed. Tenent hair at the base of the unguis, feebly clavate. *Clothing* of scales upon the head, body and ventral surface of the furcula. Antennae and legs with a dense clothing of fringed setae. Dorsal crenulations on the dentes ending at a distance of four mucro lengths from the apex of the latter. *Length* 1.1 mm.

Crieff Hills, Nov. 17, 1930; found in leaf mould.

Rondeau Park, Aug. 3, 1931.

Pottageville, Mar. 26, 1931; Apr. 23, 1932; in leaf mould.

Lepidocyrtus cyaneus Tullb.

This blue species is common everywhere in the Toronto region, and found usually under loose, damp bark and in moss. The scales on the body produce an iridescence so that the insect often appears copper-coloured when examined alive in the field.

Toronto, May 14, 1931; under the bark of willow, elm and hawthorn.

Ottawa, Sept. 6, 1931; common under stones and wood on the banks of the Ottawa River.

Napanee, May 24, 1931; under willow bark with *Tomocerus minor*.

Belleville, May 29, 1931; found with *T. vulgaris* under boards.

Rondeau Park, Oct. 2, 1931; in leaf mould.

L. cyaneus var. *cinereus* Fols.

Ground colour yellowish with metallic grey bands on the mesonotum and on the nota of the second and third abdominal segments. Fourth abdominal segment two and one-half times as long as the third.

Belleville, Sept. 7, 1931; in leaf mould.

Rondeau Park, Oct. 2, 1931; taken under oak bark.

Chatham, July 22, 1931; plentiful in rotting corn stubble.

Lepidocyrtus purpureus Lubb.

While superficially resembling *L. cyaneus*, this species is found to be more thickly scaled than the latter. The fourth segment of the abdomen is relatively longer, four to five times as long as the third. In addition, the third antennal joint is only half as long as the second.

Kingston Mills, Aug. 30, 1931; in moss.

Toronto, Nov. 8, 1930; under oak bark. May 14, 1931; beneath the loose bark of white pine.

Lepidocyrtus violentus Fols.

Eyes absent. Entirely white, Antennae one and one-half times as long as the head. A single, feebly knobbed tenent hair on the tibio-tarsus. This active, white, scaled Collembolan, is often found beneath moist stones associated with *Onychiurus armatus*.

Belleville, Sept. 7, 1931; under moss. May 24, 1931; under boards.

Chatham, July 17, 1931; in decaying corn stalks.

Kingston, Aug. 29, 1931; under loose limestone.

Chatham, July 28, 1931; under poplar bark.

Lepidocyrtus albicans Reut.

Specimens collected from leaf mould at Chatham agree closely with Guthrie's form from Minnesota. Our specimens are larger—2 mm. The strongly projecting mesonotum is characteristic of the species.

Chatham, Aug. 8, 1931.

Niagara Glen, Nov. 14, 1931; in moss.

Rondeau Park, Aug. 3, 1931; in leaf mould.

Lepidocyrtus albus Pack.

Entirely white with the exception of two pairs of eyes on small black patches. Antennal ratios: 4, 9, 7, 15. Mesonotum not projecting. Abd. IV three times as long as three. Unguis with a pair of basal teeth on the inner margin, and a single one in the middle. Inferior claw, lanceolate and untoothed.

Chatham, July 25, 1931; under poplar bark.

Belleville, May 31, 1931; under boards.

Grimsby, Nov. 10, 1930.

Crieff Hills, Nov. 27, 1930.

Sira buskii Lubb.

Dark blue-black with metallic sheen due to the presence of scales. Head, base of Ant. I, furcula and legs yellowish. Eyes on a black patch which is joined anteriorly to the bases of the antennae by a thick band of pigment. Bases of femora and the manubrium pigmented on some specimens. The appendages are more hairy than those of *S. nigromaculata*.

Belleville, Aug. 19, 1931; under apple tree bark.

Elora, Oct. 12, 1931; in crevices of a limestone cliff.

Pottageville, Nov. 1, 1931; under hemlock bark.

Toronto, Jan. 1, 1931; Biological Bldg., University of Toronto.

Chatham, July 28, 1931; on dry poplar bark.

Sira nigromaculata Lubb.

Except for slight variations in pigmentation, our form agrees closely to Lubbock's description. Yellow or greyish yellow with black bands and markings. A narrow band is present on the posterior margin of Abd. III, widening laterad to form an irregular triangle on each side of the segment. Abd. IV dorsally with an irregular H-shaped marking and also with pigment rimming the posterior margin of the same segment. Posterior half of Abd. V, and the whole of Abd. VI, pigmented. A black spot lies on the front of the head and is joined to the eye-patches by a heavy line. Furcula yellow.

Belleville, June 16, 1931.

Napanee, May 24, 1931.

Chatham, July 17-23, 1931; on dry boards in experimental cages.

Toronto, April 5, 1932; on window-sill of the Biological Bldg., University of Toronto.

Subfam. Sminthuridinae

Synopsis of Genera

1. Abdominal segments V and VI fused; male antennae morphologically different from those of the female. *Sminthurides* Börn.
2. Segments V and VI of abdomen, distinct. Male and female antennae similar. *Sminthurinus* Börn.
 - (a) Yellow, unicolorous. *S. aureus* Lubb.
 - (b) Body with lateral purple bands. *S. elegans* Fitch

Sminthurides signatus Kraus.

Male: Head and dorsal region of the body purple, laterally shading into a buff colour. Legs purple throughout. Furcula faintly purple. Antennae longer than the head (7:5). Terminal joints secondarily annulated. Segmental ratios as follows: 6, 11, 21, 35. In this sex, Ant. IV, is clearly divided into four sub-segments. Eyes 8+8 on a black patch. Prothoracic unguis slightly longer than the remaining claws, minutely unidentate on their inner margin. Outer tooth half way from the base of the unguis. Basal lamella of inferior claw, narrow, tapering, about four-fifths as long as the unguis, branching distally into a single filament. Dens more than three times as long as the mucro. Mucro subdivided into twelve plates.

Female: Head and body olive coloured; buff pigment absent. Antennae purplish. Ratios, 3, 4, 6, 13. Antennal segment IV divided into seven subsegments. Proximal subsegment equal in length to the distal one. Legs, excepting the distal third of the tibio-tarsus, unpigmented. Claw similar to those of the male. Distal half of dens unpigmented. Mucro, distally hooked, but with only seven to eight subplates.

Pottageville, May 11, 1931; collected in sphagnum moss.

Sminthurinus aureus Lubb.

This form, taken at Belleville, varies somewhat from the original description, especially in respect to the relative lengths of the antennal segments. Ant. III is only slightly longer than the second segment, not twice as long. Yellow with grey scattered pigment over the body and legs. Antennae steel grey, basal joints paler. A double spot is present on the head between the bases of the antennae. Eyes 7+7 on a dark patch. Unguis unarmed, with at least three clavate tenent hairs. Inferior claw basally lamellate, tapering sharply, finally ending in a filament. Mucro narrow, tapering, minutely serrate dorsally.

Belleville, June 1, 1931.

Sminthurinus elegans Fitch

Ground colour yellow. Body with a wide lateral purple band, below which, the insect is completely yellow. Body, dorsally with a dark median red line on which lie transversely four pairs of irregular purple spots. Antennae brown, darker on the last two segments. Relative lengths, 1, 2, 3, 10. Antennae elbowed between joints III and IV. Dens three times as long as mucro. Length, .8 mm.

Niagara Glen, Nov. 14, 1931; in moss.

Subfam. Sminthurinae

1. Tibiotarsus with 2-3 clavate tenent hairs. Genital segment of male, with a clasping organ of hooks and curved bristles.

Bourletiella (Banks) Axels.

2. Tibiotarsus without adjacent, clavate tenent hairs. Genital segment of male without clasping hooks.

Sminthurus Lat.

Bourletiella arvalis Fitch.

Head entirely yellow, except for a black spot between the bases of the antennae, which forms the apex of a V-shaped brown marking on the front of the head. The last two segments of the antennae are pale purple. Body yellow or yellowish brown. Legs and furcula yellow.

Antennal ratios, 5, 12, 18, 35. Antennal segment IV with ten sub-segments, the first three more or less fused. Unguis with an inner tooth half way on the inner margin, and outer tooth one-third from its base. Inferior claw two-thirds as long as the unguis, with an inner basal tooth. Tibiotarsus with two knobbed tenent hairs. Dens three times as long as mucro. Mucro elongate, spoon-shaped, and non-serrate on both edges. Length, 1.3 mm.

Belleville, June 14, 1931; on leaves of aster and hollyhock

Bourletiella pruinosa Tullb.

Body, head and legs, slate coloured. Yellow between the eyes, intergrading with the white margins of the eye-patches. A pair of longitudinal yellow dotted lines on the anterior dorsum of the body. Ant. IV subsegmented distally into six joints. Unguis with an outer tooth half way from its base, and an inner one one-third from the apex. Inferior claw one-half as long as the unguis, basally triangular, distally acuminate. Two clavate hairs present on the tibiotarsus. Manubrium longer than the dentes, (19:15). Mucro narrow, non-serrate. Eyes 8+8.

Belleville, June 17, 1931; found in moss.

Sminthurus minnesotensis Guth.

The single specimen in our collection, agrees essentially with Guthrie's species, in respect to pigmentation, and other characters. Dens about three times as long as the mucro, the latter, only feebly serrate. Prothoracic unguis, with a minute double outer tooth.

Rondeau Park, Oct. 3, 1931; in leaf mould.

Bourletiella spinata Macg.

The distinguishing character of this aquatic species, is the highly adapted furcula, with its spoon-shaped mucro, and long inner setae on the dentes. Specimens agree structurally with Guthrie's description. Variations occur in colour markings only.

Toronto, June 1931, F. P. Ide.

Subfam. Dicyrtominae

Dicyrtoma unicolor Harv.

Brownish yellow, with a tendency to purple along the posterior dorsum of the body. Head yellowish brown. Antennae slightly shorter than the body, the last two segments purplish. Eyes 8+8, on a black patch. Unguis with two inner teeth, one-third and two-thirds

respectively from the base. Inferior claw widened basally, with a prominent inner tooth, two-thirds as long as the unguis, distally branched, the filament extending to the apex of the unguis. Dens three times as long as mucro. Length, 2 mm.

Toronto, Oct. 18, 1931; upon wood and leaf debris.

Elora, Oct. 12, 1931; very common upon wet leaves in the woods.

Niagara Glen, Nov. 15, 1931; very common upon fallen leaves with *Achorutes macgillivrayi* and *Onychiurus armatus*.

Dicyrtoma maculosus Schött

Prevailing body colour grey, flecked with yellow spots. Last two segments of the antennae purple. Bases of the legs, and also the furcula, purple. Tibiotarsi white distally. Ant. I sub-equal to Ant. IV. Ant. III sub-divided into 7-8 segments. Unguis with two distinct inner teeth. Inferior claw on middle and hind legs, including its branched filament, longer than the unguis. Dentes with both simple and pinnate setae.

Rondeau Park, Oct. 4, 1931. Three individuals only were collected from leaf mould in a pine wood.

Dicyrtoma testudineatus Fols.

Blue-black. Body marbled dorsally with five transverse, yellow, irregular bands, which unite at the mid-line. Head yellow, with alternate blue stripes. Legs mottled. Furcula yellow. Ant. IV with seven subsegments. Dentes three times as long as the mucro, bearing dorsally a row of long pinnate setae. Mucro strongly serrate.

De Grassi Point, Aug. 8, 1915, E. M. Walker.

LITERATURE CONSULTED

- ABSOLON, K. 1901. Ueber einige theils neue Collembolen aus den Höhlen Frankreichs und des südlichen Karstes. Zool. Anz., Vol. 24: 82-90.
1901c. Ueber *Neanura tenebrarum* n. sp., aus den Höhlen des mährischen Karstes. Zool. Anz., Vol. 24: 575-586.
- BACON, G. A. 1914. The Distribution of Collembola in the Claremont and Laguna Region of California. Proc. Calif. Journ. Ent. and Zool., 137-180.
- BROWN, J. M. 1921. The Swarming of Collembola. The Naturalist. London, 129.
- BÖRNER, C. 1901a. Vorläufige Mittheilung über einige neue Aphorurinen und zur Systematik der Collembola. Zool. Anz., Vol. 23: 1-5.
1901c. Neue Collembolenformen und zur Nomenclatur der Collembola Lubb. Zool. Anz., Vol. 24: 696-712.

- CARPENTER, G. H. and EVANS, W. 1899. The Collembola and Thysanura of the Edinburgh District. Proc. Royal Phys. Soc. Edinburgh, Vol. 14: 221-266.
- COLLINGE, W. E. and SHOEBOOTHAM, J. W. 1910. The Apterygota of Hertfordshire. Journ. Econ. Biol., Vol. 5: 95-132.
- DENIS, J. R. 1926. Notes sur les apterygotes. Le Dimorphisme Sexuel d'*Archisotoma besselsi* (Pkd.) Soc. Zool. de France, Bull. 51, 52: 16-19.
- FOLSOM, J. W. 1902. Papers from the Harriman Alaskan Expedition (Apterygota). Proc. Wash. Acad. of Sci., Vol. 4: 87-116.
1914. North American Springtails of the Subfamily Tomocerinae. Proc. U.S. Nat. Mus., Vol. 50: 477-525.
1916. North American Collembolous Insects of the Subfamilies Achorutinae, Neanurinae, and Podurinae. Proc. U.S. Nat. Mus., Vol. 50: 477-525.
1917. North American Collembolous Insects of the Subfamily Onychiurinae. Proc. U.S. Nat. Mus., Vol. 53: 637-659.
1918. A New *Isotoma* of the Snow Fauna. Can. Ent., 50: No. 9, 291-292.
1919. Collembola from the Crocker Land Expedition, 1913-17. Bull. Amer. Mus. Nat. Hist., Vol. 41, Art. 3, 271-303.
1924. New Species of Collembola from New York State. Amer. Mus. Novit., No. 108: 1-12.
1919. Report of the Canadian Arctic Expedition, 1913-18, Vol. 3, part A, Ottawa.
- FITCH, ASA. 1862. Eighth Annual Report on the Noxious and other Insects of the State of New York. Trans. New York State Agric. Soc., 668-675.
- GUTHRIE, J. E. 1903. The Collembola of Minnesota. Rep. Geol. Nat. Hist. Surv. Minn., Zool. Series No. 4: 1-110.
- HANDSCHIN, F. 1924. Ökologische und biologische Beobachtungen an der Collembolen Fauna des Schweizerischen Nationalparks. Verhand. der Naturf. Gesell., Basel., Vol. 35: 71-101.
- HARVEY, F. L. 1892. A New *Sminthurus*. Ent. News, Philadelphia, 169-170.
1893. A New *Achorutes*. Ent. News, Vol. 4: 182-184.
1894. A New *Lepidocyrtus*. Ent. News, Vol. 5: 324-326.
1900. A New Maine Collembolan. Ent. News, Vol. 11: 549-53.
- JACKSON, A. D. 1907. Synopsis of the American Species of the Genus *Papirius*. Ohio Nat., Vol. 7, No. 8: 159-177.
1909. A study of the Ohio forms of the Genus *Lepidocyrtus*. Ohio Nat., Vol. 9: 525-534.

- LIE-PETERSON, O. J. 1896. Norges Collembola. Bergens Mus. Aarbog. No. 8: 1-24.
- LINNANIEMI (AXELSON), W. M. 1912. Die Apterygoten-fauna Findlands II, Spezieller Teil, Helsingfors.
- LUBBOCK, J. 1873. Monograph of the Collembola and Thysanura. Ray Soc., London.
- MACGILLIVRAY, A. D. 1891. A Catalogue of the Thysanoura of North America. Can. Ent., Vol. 23: 267-276.
1893. North American Thysanoura. Can. Ent., Vol. 25: 313-318.
1896. The American Species of Isotoma. Can. Ent., Vol. 28, No. 1: 47-58.
- MACNAMARA, C. 1919. Remarks on the Collembola. Can. Ent., Vol. 51, No. 4: 73-81; Vol. 51, No. 11: 241-245.
1920. A New Species of Pseudachorutes. Can. Ent., Vol. 52, No. 8: 173-176.
1921. Friesia sublimis. Can. Ent., Vol. 53, No. 6: 126-129.
1922. Two New Species of Achorutes. Can. Ent., Vol. 54, No. 7: 149-153.
- MAYNARD, E. A. 1931. Seventeen Additions to the Collembola of New York. Bull. Brooklyn Ent. Soc., Vol. 26, No. 5: 217-220.
- PACKARD, A. S. 1873. Synopsis of the Thysanura of Essex County, Mass. Fifth Ann. Rept. Trust. Peabody Acad., 23-51.
- POPPE, C. A. and SCHÄFFER, C. 1897. Die Collembola der Umgegend von Bremen. Abh. Naturw. Ver. Bremen, Vol. 14: 265-272.
- REUTER, O. M. 1895. Apterygogenea Fennica. Acta. Soc. Fauna Flora Fenn., Vol. 2, No. 4: 1-35.
- SCHÖTT, H. 1896. North American Apterygogenea. Proc. Calif. Acad. Sci., series 2, Vol. 6: 169-196.
- TULLBERG, T. 1872. Sveriges Podurider. K. Svenska Vet. Akad. Hand., Vol. 10, No. 10: 1-70.
- WILLEM, V. 1900. Recherches sur les Collembolles et les Thysanoures. Mem. cour. Mém. sav. étr. Acad. Royale Belgique, Vol. 58: 1-144.
- WOMERSLEY, W. M. 1930. The Collembola of Ireland. Proc. Royal Irish Acad., Vol. 39: 160-202.

EXPLANATION OF PLATES

PLATE I

- Fig. 1. *Isotoma multispinata*.
 " 2. Right dens and mucro.
 " 3. Claws of right middle leg.
 " 4. Clothing of setae on Abd. V.
 " 5. Right eye-patch, with postantennal organ.
 " 6. Left mucro, left aspect.
 " 7. Left mucro and end of dens, right aspect.
 " 8. Left tenaculum.

PLATE II

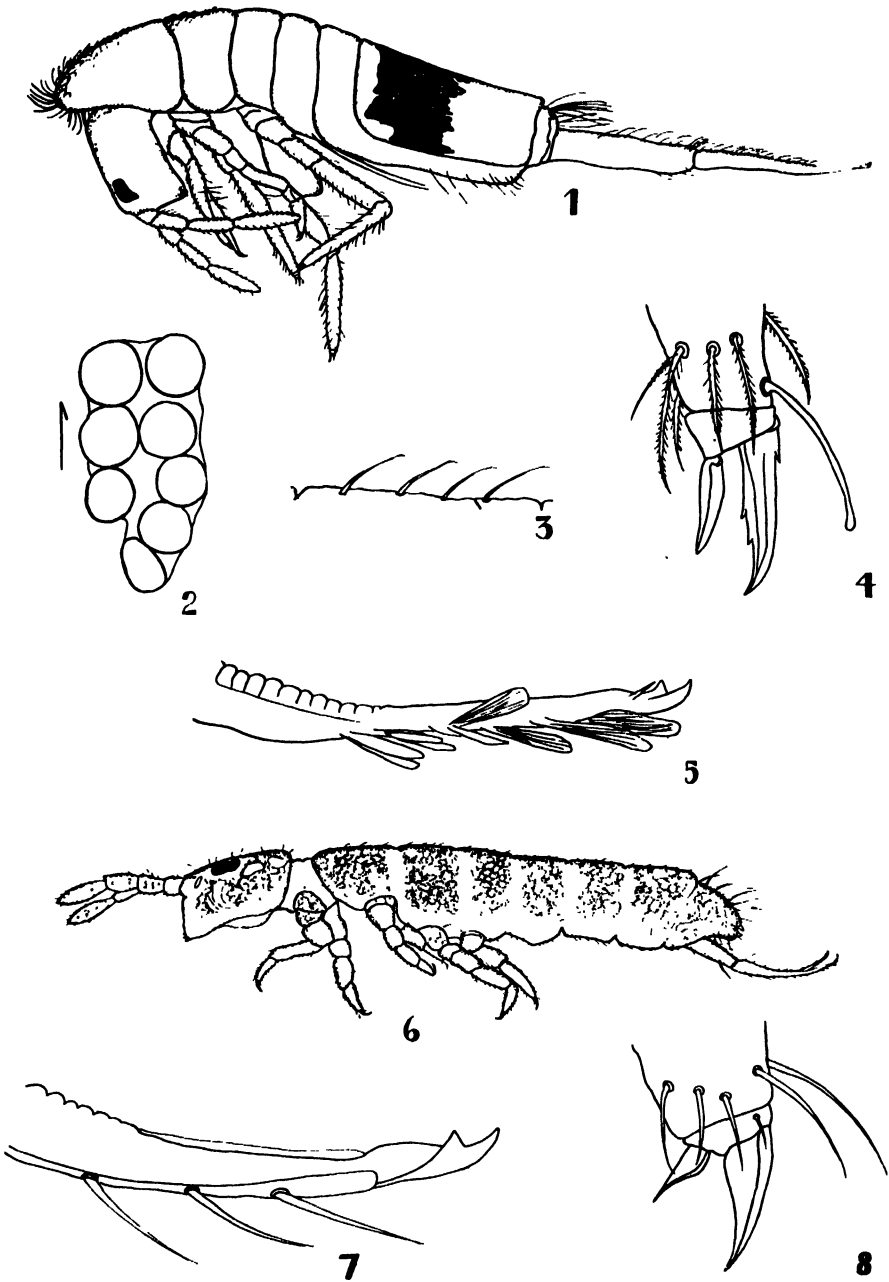
- Fig. 1. *Lepidocyrtus unifasciatus*, left aspect.
 " 2. " " right eye-patch.
 " 3. *Proisotoma similis*, dorsal setae on Abd. I.
 " 4. *Lepidocyrtus unifasciatus*, claws of right middle leg.
 " 5. " " left mucro and end of dens.
 " 6. *Proisotoma similis*.
 " 7. " " left mucro.
 " 8. " " claws of right middle leg.

PLATE III

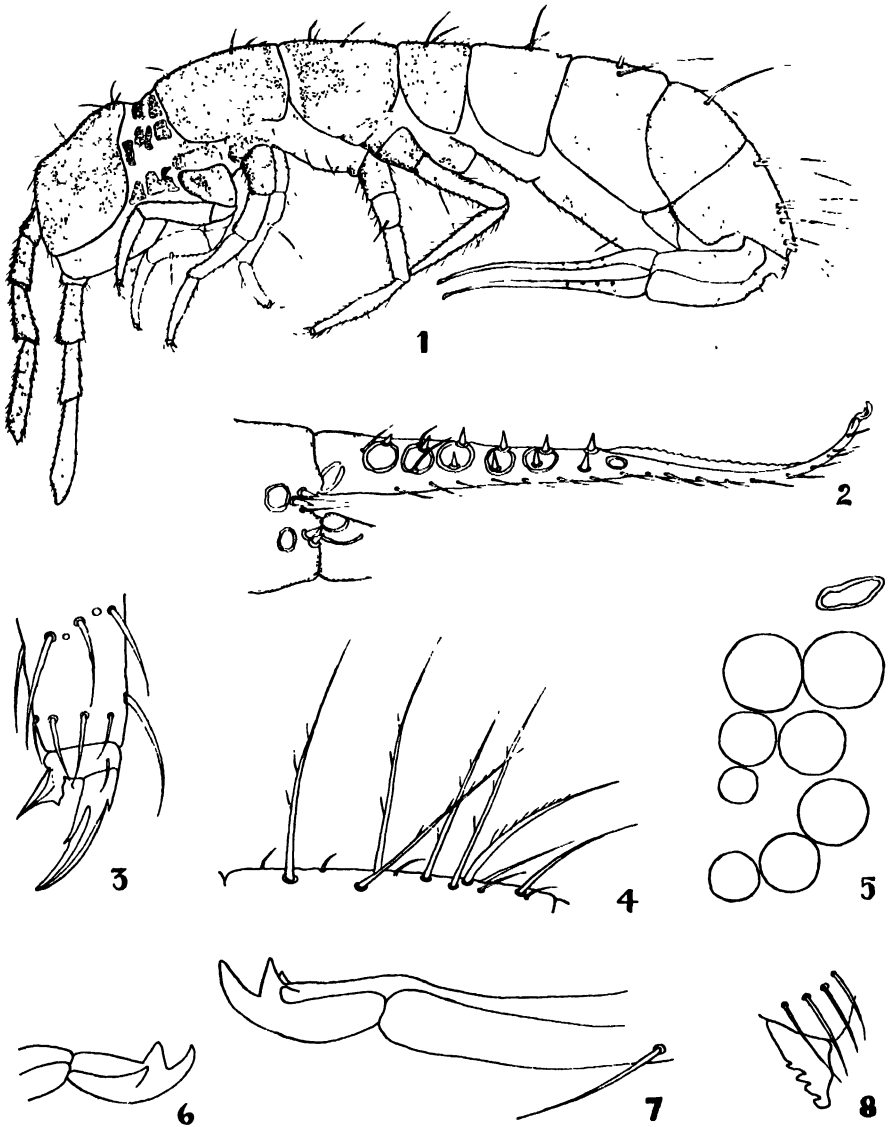
- Fig. 1. *Proisotoma similis*, left eye-patch, with postantennal organ.
 " 2. *P. similis*, dorsal setae on Abd. V and VI.
 " 3. *Xenylla pseudomaritima*, sense organ on Ant. III.
 " 4. " " anal spines on Abd. VI.
 " 5. " " left aspect.
 " 6. " " prothoracic unguis.
 " 7. " " left eye-patch.
 " 8. " " manubrium and mucro-dentes.
 " 9. " " right mucro-dens, lateral aspect.
 " 10. " " dorsal setae on thorax III.

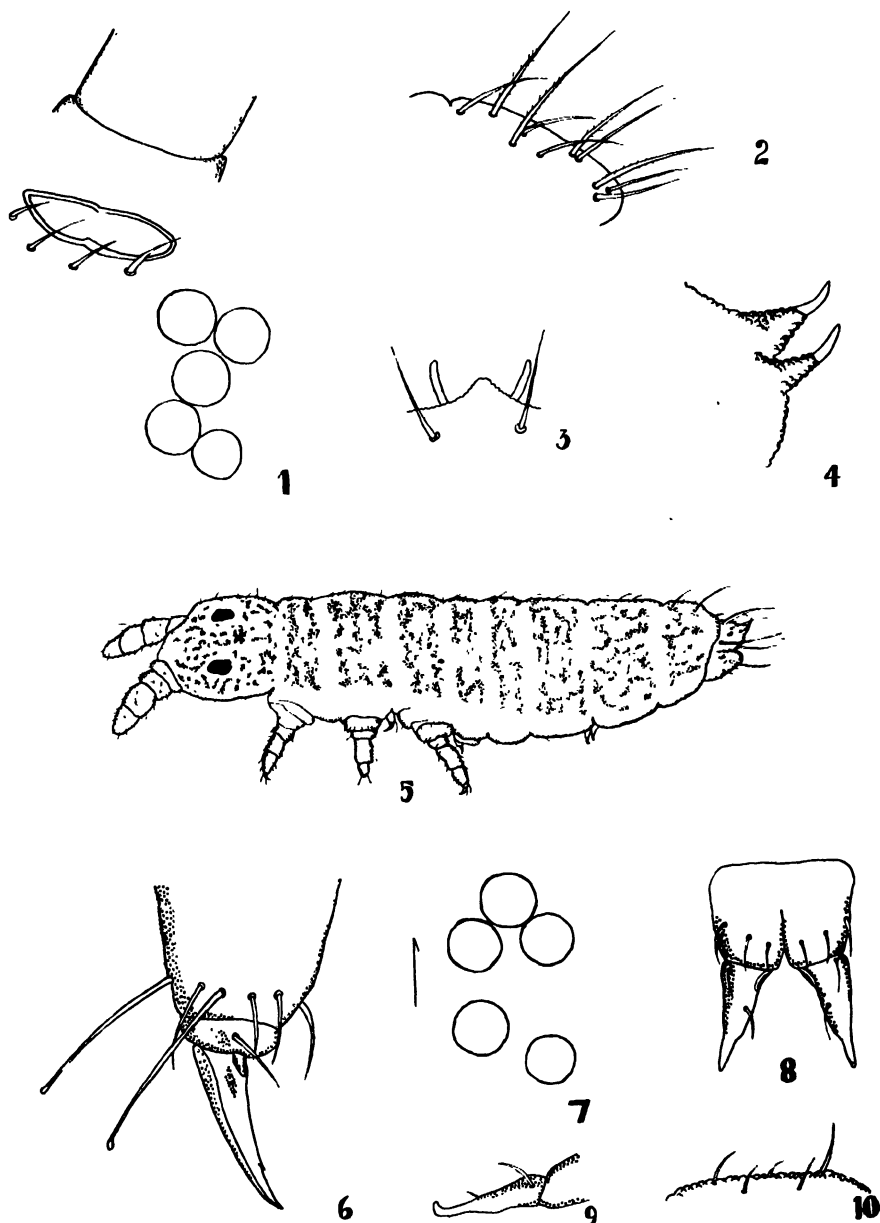
PLATE IV

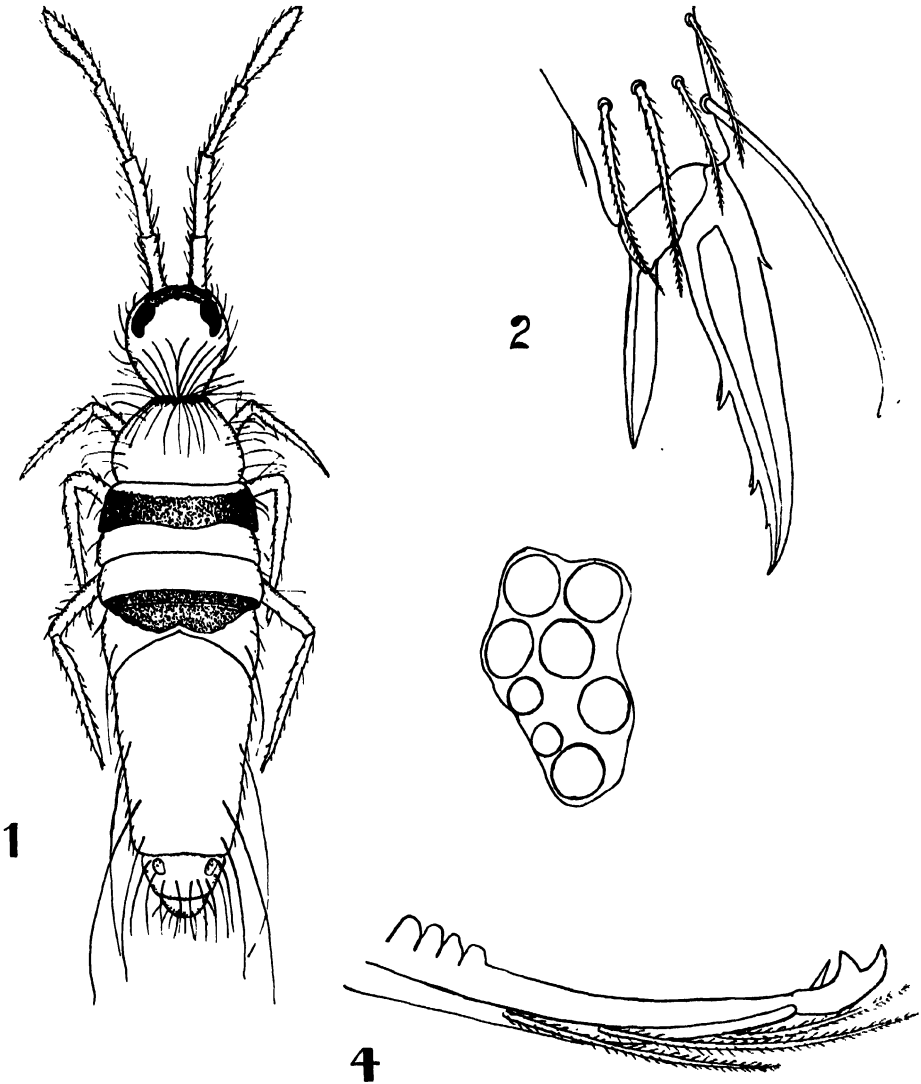
- Fig. 1. *Entomobrya ontarionensis*.
 " 2. Claws of right middle leg.
 " 3. Right eye-patch.
 " 4. Right mucro and end of dens.



JAMES—COLLEMBOLA OF THE TORONTO REGION WITH NOTES ON THE BIOLOGY OF ISOTOMA PALUSTRIS MUELLER







JAMES—COLLEMBOLA OF THE TORONTO REGION WITH NOTES ON THE BIOLOGY OF *ISOTOMA PALUSTRIS* MUELLER

SOME OBSERVATIONS ON THE ALBATROSSES AND OTHER BIRDS OF THE SOUTHERN OCEANS

By CAPT. C. C. DIXON

The observations reported in this paper were made over a period of twenty-seven years (1892-1919), during which time 2,002 days were actually spent at sea between 20° and 60° south latitude.

The first notes were set down on my first voyage to sea after leaving school in 1892. The work was dropped for long periods between that year and 1901 when I went in steam and did not visit the albatross latitudes. In 1904, I was back in sail, now in command, and too busy with my new job to give attention to this subject, but in 1906 I began again. I was then keeping the four-hourly log for the Meteorological Office, London, and it involved little additional labour to record my observations on birds. From this date until I left sail in 1919, I kept records every day in the albatross latitudes of the species given in the following list and charts.

Of this time about 3,500 days were spent at sea and about 2,000 of them south of 20° south latitude. Some observations were set aside as doubtful, but 1,744 were retained as the basis for the conclusions presented below. These observations were summarized in the form of charts and tables, one of each for each of the different species of bird treated. The charts, except that for the albatrosses of the genus *Diomedea*, are not included in the present paper, but are on file in the Royal Ontario Museum of Zoology, Toronto, where they may be consulted by anyone interested in obtaining more complete data than are presented here. Some account of the habits of a number of the species are also included.

Of the 1,007,208 miles of ocean covered while I was in sailing ships, about 250,000 miles were within the albatross domain. The ship's track in these waters for the passages on which daily records were kept is shown in Figure 1. A list of the passages is given in Table 1. Only those portions of the passages on which observations were made are included in the charts. These are all south of 20° south latitude, and are designated by corresponding letters (B, D, E, etc.), in the table and on the charts.

In addition to the passages listed in this table a few observations were made on the following passages: Capetown to Albany, West Australia, August-September, 1899; Albany to London, 1902; Barry, South Wales

to Capetown, September-December, 1901, and Sydney to Liverpool, 1895. The tracks of these passages are omitted from the charts, but the observations are included in my records.

TABLE 1 GIVING A LIST OF PASSAGES ON WHICH OBSERVATIONS WERE MADE

| | <i>From</i> | <i>To</i> |
|--------------|------------------------|-------------------------------------|
| B 1907 | Sydney, Australia | Rotterdam, Holland |
| D 1907-8 | Portland, Oregon | Queenstown, Ireland |
| E 1908 | Glasgow, Scotland | Sydney, Australia |
| F 1909 | Newcastle, N.S.W. | Talchuano, Chile |
| G 1909 | Talchuano | Queenstown |
| H 1909-10 | Newcastle-on-Tyne | Portland, Oregon |
| K 1910 | Portland | Queenstown |
| L 1910-11 | Port Talbot, Wales | Caleta Coloso, Chile |
| M 1911 | Victoria, B.C. | East London, South Africa |
| N 1912 | East London | Port Pirie, S. Australia |
| P 1912 | Port Pirie | Queenstown |
| R 1912-13 | Rio de Janeiro, Brazil | Adelaide, S. Australia |
| S 1913 | Port Pirie | Queenstown |
| T 1914 | Santos, Brazil | Balla Balla, N.W. Australia |
| V 1914 | Balla Balla | Liverpool, England |
| W 1915 | Philadelphia, U.S.A. | Fusan, Korea |
| X 1916 | Portland, Oregon | Queenstown |
| Y 1917 | Port Arthur, Texas | Melbourne, Australia, via Panama |
| Z 1917 | Melbourne | Durban, South Africa |
| KK 1895 | Rio de Janeiro | Sydney, Australia |
| NN 1896 | Rio de Janeiro | Sydney, Australia |
| EE 1896 | Sydney | Acapulco, Mexico |
| ZA 1897 | Vancouver, B.C. | London, England |
| GG 1898 | Barry, South Wales | Cape Town, S. Africa |
| MM 1898 | Cape Town | Albany, Western Australia |
| BB 1899 | Albany, W. Australia | London |
| ZD 1899 | Barry, South Wales | Cape Town |
| HH 1899-1900 | Albany, W. Australia | London |
| ZB 1900 | Barry | Cape Town |
| DD 1901 | Albany, W. Australia | London |
| ZC 1902 | Cape Town | Albany, W. Australia |
| PP 1917 | Durban, South Africa | Paagoumene, New Caledonia |
| SS 1918 | Paagoumene | New York, U.S.A. |
| TT 1918-19 | New York | Sydney, Australia |
| VV 1919 | Sydney | Liverpool, England |

LANDS AND ISLANDS

"The Horn". The southernmost island of the lands and islands that lie to the southward of the South American continent is called "the Horn" by all seafarers. It is seldom spoken of as Cape Horn.

"The Cape". Is the southern coast of South Africa from the real Cape of Good Hope to Algoa bay. Sometimes "the Cape" is used as meaning only the very southern portion of the Agulhas district. Never by any chance do seamen call the district the "Cape of Good Hope". It is always "the Cape".

"The Leeuwin" is the southwest corner of West Australia. It is never called Cape Leeuwin. The phrase applies to the district from Albany, or King George's Sound, to the real point of Cape Leeuwin.

Tristan da Cunha island. In the south Atlantic, about 1,470 miles west and 190 miles south of Cape Town, South Africa, in latitude 37° - 03° S. and longitude 11° - 18° west. With it are generally included two other small islands and their outlying rocks, the Nightingale and Inaccessible island.

Gough island. About 190° south and a little east of Tristan da Cunha. These two groups (4 and 5) were visited by the Shackleton-Rowett Expedition and are fully described by them in the *R.G.S. Journal* of February, 1923.

From the Cape across the Indian ocean in the southern routes the first group of islands met with are:

Prince Edward, or Marion, group of islands. They consist of two small groups, the Marion and the Prince Edward islands, and the whole group is called by either name. They lie between the parallels of 46° - 40° and 46° - 53° south latitude and between longitude 37° - 33° and 37° - 55° east. Then still farther east are:

The Crozets, between latitudes 46° - 01° and 46° - 36° south and the longitudes of 50° - 35° and 52° - 13° east. Then a little farther yet to the eastward is the island or land of

Kerguelen, a great island of some 3,000 square miles that with its surrounding islets and rocks extends from longitude 68° - 13° to 70° - 30° east and north and south from 48° - 27° to 49° - 44° of south latitude. Then a little farther east but much farther north in the winter routes to Australia are the islands of

Amsterdam and St. Paul's. Though these two islands are some sixty miles apart they are generally spoken of as Amsterdam and St. Paul's, a single group.

None of these islands are permanently inhabited except Tristan de Cunha.

Nimrod. In the south Pacific, there was once reported to be a large

island called Nimrod. It is now fairly certain that there is no island in that part of the ocean, but the region is often mentioned in this paper on account of the numbers of birds that frequent this area. It is more convenient to speak of it as the Nimrod island region than to specify it any other way. The part where the island was reported to exist is about 10° south of the south part of New Zealand and 25° east of it in latitude $56\frac{1}{2}^{\circ}$ and longitude $158\frac{1}{2}^{\circ}$.

Straits of Le Marie lie between the eastern point of Tierra del Fuego and Staten island or Staten land as it is sometimes called. This strait is also a favourite haunt for birds, probably on account of its strong currents and tides that continually disturb the water and bring to the surface great quantities of the various species of food. Then about 250 miles northeast of this strait lie the

Falkland islands, a large group that is well known more especially since the war and the famous battle that took place near them. A full description of them and the straits of Le Marie can be found in British Hydrographic Department publication "South America Pilot", Volume 1.

THE CHARTS

The charts are on Mercator's projection and cover the region between 20° and 60° S. Lat. right around the globe. They are divided into "squares" of a size that seems to be most suitable for the purpose. The square adopted is 15° of longitude by 10° of latitude. These dimensions in the central latitudes are not far from a real square, being 636 by 600 miles.

Between 20° and 30° S., about $5\frac{1}{2}$ squares are land and in four of the ocean squares no observations were made. Between 30° and 40° S. about four squares are land and in one ocean square there were no observations. Between 40° and 50° S. about one and a half squares are land and there are observations in all ocean squares. Between 50° and 60° S. about one-half square is land and about eight covered with pack ice. In five squares there were no observations but they are in regions entirely unfrequented by merchant ships.

Because of the vastness of the region in which these observations were made there is need for many more records before we can have an adequate knowledge regarding the migrations or even the distribution of the birds in question. An expedition sent out especially to collect observations on the birds throughout this vast area would require many years. My observations were made on 1,744 days, which is equivalent to almost five years and this takes no account of the time required to reach the area where the observations were made.

An indication of the completeness with which I was privileged to

visit the regions dealt with, is given by the fact that between 30° and 50° S., the region most frequented by the birds described in this paper, there is only one square in the ocean portion in which no observations were made.

The numbers in the upper left-hand corner of the squares indicate the number of days on which observations were made in the areas represented. The numbers in the centre of the squares represent the number of birds observed per thousand square miles in the corresponding areas. These numbers were obtained by dividing the total number of birds seen in each square by the number of days on which observations were made and multiplying by 12½. The reason for multiplying by 12½ is as follows:

The average speed of a sailing vessel between the 30° and 60° S. may be taken as about 160 miles per 24 hours (the region between 30° and 20° is not considered, as so few birds are seen there. The speed average is generally much lower in this area). While the hours of daylight vary greatly in the higher latitudes with the change of season, only in mid-winter and south of 50° could the sun rise later than 8 a.m. or set before 4 p.m. Thus the hours of daylight might be considered as twelve. In the long summer days there were no observations before 6 a.m. and few after 6 p.m. The average distance covered during which observations were made was therefore about eighty miles. It also was assumed that every bird within a half mile either side of the ship's track was noted; at this distance any of the species could be seen with the unaided eye and the larger ones identified. Binoculars were used in cases of doubt. The area in which the birds were counted each day may therefore be taken as averaging about eighty square miles. To obtain an average for a thousand square miles it is therefore necessary to multiply by 12½.

Diomedea exulans—WANDERING ALBATROSS

The Wandering Albatross (*Diomedea exulans*) is the albatross of all those that go down to the sea in ships, as well as of all writers of sea stories, and is also the albatross of the "Ancient Mariner".

The other members of the genus occurring in the southern ocean, such as the Royal Albatross (*D. regia*), and the White-winged Albatross (*D. e. chionoptera*), are so similar to the common albatross on the wing, that I was unable to distinguish them in making the observations reported herein, and hence these notes apply to a genus rather than to a species.

The wandering albatross, however, far outnumbers the others so that the data presented here must give a fairly accurate idea of the abundance and movements of that species.

Distribution and movements.—My records indicate that these albatrosses are practically confined to the area between 30° S. and 60° S. I

have observed very few north of 30° S. and none within the tropics. The farthest north I have seen one is 24° S., off the Brazilian coast, in summer. This was unusual as most of those seen north of 30° are observed in winter and spring. There is a good deal of variation in the density of their numbers in different regions, depending on season. Thus, in spring, 92% of the birds seen were between 30° and 50° and only 3% south of 50° , whereas in summer 73% were between 30° and 50° , and 26.5% south of 50° . In autumn there is a shift northward again, and by winter 96.9% are between 30° and 50° and only 0.1% south of 50° . The table also indicates a similar seasonal shift in longitude. In winter and spring the vast expanse of ocean from the 120th meridian of west longitude to the Horn is practically deserted, whereas in summer this region is the favoured one. There seems to be a progressive shifting of the centre of abundance from west to east each season as if the birds flew around the earth from west to east with the prevailing winds. For instance, in winter 82% are on the hemisphere 0.90° E- 180° ; in spring the centre of abundance has shifted slightly towards the east so that 73.5% are in the hemisphere 90° E. to 90° W.; in summer 67% are in the hemisphere 180° - 90° W.-0, and in autumn 63% in 90° W. to 90° E.

It is interesting to note that in summer there is a considerable concentration of albatrosses in the region of the cold currents off the west coast of South America, and up past the Falkland islands in the Atlantic.

The greatest number ever seen together was estimated at fifty, close to Tristan da Cunha in summer. On one occasion, forty were seen near Crozet island. On twenty-five occasions in about as many years, flocks of ten were met with. Three or four is about the average number seen at once, and there are great numbers of instances when it was seen quite alone.

Size.—During the twenty-nine years I had the albatross under observation I have never seen any individuals larger than those I was able to catch. Of some two hundred that were caught on various voyages, forty-two were measured. The largest had a wing spread of eleven feet four inches, the smallest nine feet seven inches, and the average ten feet two inches. The corresponding weights were twenty-three pounds, thirteen pounds and seventeen and a half pounds respectively.

Flight.—Several well-known naturalists have made observations on the flight of the albatross. I shall merely record what I have personally observed on this subject. It may confirm some of the theories of others, or it may help to disprove them.

Albatrosses were seen resting in the water much more frequently in calm weather than when there was any wind, due no doubt to the fact that flight requires a greater effort in calm weather than when there are

air movements. In stormy weather they alighted only to secure food, their wings at such times being raised in readiness to avoid the breaking crest of a wave. During calms the wings were definitely used at quite short intervals, probably every five minutes or so.

But when there is a heavy swell with no wind (*i.e.*, the swell from a distant storm or one that has just passed, the wind having died down very rapidly) a very distinct air motion is created, even when such a swell is moving some 20 miles an hour. This is, of course, very apparent near shore when the tops of breaking rollers are carried back by their own onward motion, though the glassy surface of the ocean as a whole indicates no movement of the air. This air movement is to some extent actual as well as relative, and the birds can make use of the ascending currents thus created near the surface at the lowest point of their downward glide, or, by flying low over the surface, utilize this upward current instead of flapping their wings. During strong winds and storms they always make use of the ascending current on the rear of a wave, and this is sufficient to compensate for loss of elevation in the previous glide, and they can thus go practically indefinitely without moving the wings. It has been stated that they can go 40 minutes or even an hour without wing movement, but they can quite as easily continue this all day. Generally speaking, the only wing movements that take place in strong winds or storms are the sudden diversions made on sighting something afloat that may be food. The exception to this practice may be in the case of heavy storms when very few birds of any kind are seen. At such times the crests of the waves are so torn, the spray flying to a height of 15 or 20 feet above them, and in all the hollows, that the resistance of this spray would more than offset the gain in height. Thus, in real stormy weather, as much use of the wings is made as on a calm day.

The albatross seldom makes use of the upward currents of air about the weather side of a vessel as do the smaller albatrosses, petrels and gulls.

Their behaviour at night is difficult to observe. On moonlight nights in almost any kind of weather I have seen the wandering albatross and the cape petrel flying about the ship. On the other hand, I have never seen them on moonless nights, even when it was clear enough to observe them, had they been following the vessel as they did on moonlight nights. In calm weather I have seen them asleep on the water in the early morning, but quite as often at midday. The same bird, identified by a broken tail or wing feathers or broken webs in the feet, has been seen several days in succession. The distance traversed was frequently 120 miles during the hours of darkness—too far to see a vessel, except from a height of about 10,000 feet, and they are never seen above 500 feet, or very rarely above 200. Thus they cannot rise high enough to see a vessel if resting all night.

Food.—The chief food of the albatross is squids or cuttlefish, several kinds of which are found in the southern oceans. Most of the stomach contents I have examined have contained only cuttlefish beaks. It also eats various small shrimps or crab-like creatures, and dead fish if moderately fresh. Its jaws and throat can be greatly distended and I have found in its stomach great pieces of squid and once a fish considerably over two pounds in weight. I have never seen an albatross trying to catch a fish, although I have seen them follow cuttlefish.

The albatrosses and other large birds of the southern ocean are known to feed on the waste about whaling stations as well as on dead whales themselves. They will also pick up waste thrown overboard from ships, but it is usually the fat in such waste material which they secure, since they never dive after sinking portions. Its flesh can be eaten, but like that of other carnivorous birds, it is very rank.

Like other diurnal birds, it apparently never feeds at night; perhaps it cannot see very well at night. It often flies on moonlight nights but never feeds at such times. Food which appears white on the water and which never fails to bring the bird down during the day, entirely fails to attract it during moonlight.

Catching albatrosses and petrels.—In most works of fiction where the catching of the albatross is mentioned, they are described as being caught by means of a triangular piece of sheet-copper or muntz-metal, with a smaller triangular piece cut out of the centre. In this space is secured the bait with a piece of twine, the whole being attached to a piece of wood to float it, and secured to the end of the fishing line. When the bird picks it up, his hooked bill is supposed to be caught in the sharp angle of the metal, and as long as a strain is kept on the line the bird cannot get free.

This is a fine method in theory. I tried it several dozen times until I found that no self-respecting albatross would give an object of this description a second look, much less pick it up.

All the different kinds of albatrosses that I ever caught were taken with a hook and line. For the small birds an ordinary small fishhook with the barb broken off was used. The reason for breaking off the barb was that if it hooked into the flesh instead of the horny bill it caused the bird great pain, as could be seen from its frantic actions when hooked in this way, which were quite different from those when hooked in the bill. In the former case the line was always slacked and, the hook having no barb, the bird could shake itself free.

Ordinary fishhooks are unsatisfactory for catching the larger species, because in the heavier kinds the bend is so large that the bird picks it up by the shank, and so does not hook itself. I have found that even for the

largest albatross a bent wire nail was best. A three-inch nail is used, the pointed end being bent around in a half-circle of about one-half-inch diameter, and the point filed a little. This hook is buried in the bait which is tied on to it with thin twine. A float, consisting of a moderate sized strip of soft wood, is fastened about three to six feet from the hook, according to the speed of the ship. If the ship is going very slowly, say about one to two knots, the float must be close to the hook. If the float is fastened too far from the hook, the latter sinks too deep when the line is slacked away to let the bird swim after it. And the albatross does not like to wet his head. He seldom takes the hook if it is below water more than a few inches, or if he has to swim at all fast to catch it. I have never caught one with the vessel going more than five miles per hour. At such a speed there is generally too much line out by the time the bird has alighted and decided to look at the bait, for during that time the hook and float must be practically stationary on the surface of the water, which means that the line must be slacked out as fast as the ship is moving.

The wandering albatross, when hooked, sets its feet and wings so that it is drawn under water. For that reason very strong gear is needed if the ship is moving four or five knots. I have seen two good able men put forth their full strength to pull in an albatross under such conditions. In a calm, with the vessel nearly stopped, it is easy to pull them in as long as the hook is strong enough to lift the weight of the bird from the water. If they are caught at moderate speeds (two or three knots) the bird is seldom injured, the hook dropping out of the bill as soon as the line is slacked.

When hooked by such a device, the albatross is seldom injured and when brought on board is able to wander about on deck at will. On the other hand, by the use of a barb the bird is often so badly injured that its death results.

For bait we generally used raw pork with the rind on. While the birds would take any kind of fatty meats or fish, nothing else would stand a second bite from their razor-like bills, and it is seldom indeed that one is hooked the first time it tries the bait. Thus, unless the bait is very tough and securely tied on, one would be continually re-baiting hooks.

The cape pigeon or petrel comes so close to the vessel that it can often be caught with a butterfly net.

Several of the birds discussed in this paper can be caught, when flying close to the vessel, with a primitive weapon made as follows: Two small weights are attached to the end of a piece of thin fishing-line about four feet in length, with a long line attached to the centre of the four-foot line. If such a weapon strikes a bird, it winds itself around the body and wings so that the bird may be drawn on board. This device is a variation of that used by aborigines in catching ostriches.

The albatross in captivity.—There is a generally accepted belief that the albatross cannot be brought north of the equator. I have never actually brought one north, but I see no reason for believing that it can not be done. I have seen one flying about in latitude 27° south, when the air temperature was near 80° F. I have also had one in the ship for fourteen days, a period long enough to have landed it in the northern hemisphere under conditions of temperature, etc., similar to those in which it lives farther south.

The albatross I had was left loose about the deck from which it was unable to rise because there was not a sufficiently long clear space where he could get a "run". When taking off from the water they need a considerable run on a "calm" day.

During the time the specimen referred to above was on the ship, it took its food from a large tub of clean salt water.

Some superstitions.—There used to be a very general belief among sailors that when a skipper dies his soul passed on to the albatross, and that when a hard-boiled mate passed out his soul, if any, passed on to the smaller albatross known as mollyhawks. As there seemed to be quite a few varieties of these even to an unobserving seaman, the souls of the common seamen were also allotted one of them, while coloured cooks and stewards found their abode in the funeral cape hen or the giant petrel, and middies or deck-boys cut off in the flower of their youth passed into the noisy, irresponsible cape pigeon.

The albatross retains a little of the humour of the tough skipper who used to take pot shots at the sailors aloft, to see them jump or yell if the bullet nicked a piece out of them.

I first learned of the albatross's perverted sense of humour one day in a small boat in the South Atlantic. We were trying to catch an albatross that was very wary of any kind of hook or bait. So I determined to try from the small boat away from the ship.

The albatross had disappeared for the moment, but when I stood up in the boat to have a wider horizon, I suddenly saw him coming straight at my head in a steep glide with engine full on. To me he looked like a winged sixteen-inch shell. I let myself drop into the bottom of the boat. As he flashed past he turned and surely winked at me.

He had vanished again over the horizon and while we were watching for him in that direction, the second mate gave a shout: "Look out for your head!" and we all dropped as he flashed past from the original direction. And again that turn of the head and apparent wink. All right! two can play at this, and we prepared to hit him with an oar as he passed, if we could be quick enough. But he did not come; he changed his tactics and became friendly. He landed near the boat in a very bad

landing, having to use his feet as brakes, then swam right over to the boat so that we could have patted his head—if his head had been muzzled. We held out a piece of fat on a stick. He took it. We left a piece on the gunwale of the boat. He took that. We finally wanted to catch him, but his eyes seemed to be everywhere—the slightest move on the part of anyone and he faced that one.

We finally did catch him, with a small hook and line, and took him aboard the ship—but to please the sentimental, we can say that he was not killed, but let go again, after painting in small letters the ship's name under his wing.

The albatross and sharks.—On three occasions I had the opportunity of observing the attitude of albatrosses and sharks towards one another. On each of these occasions we had the small boat out when both albatross and sharks were close to us and to one another at the same time. At first it seemed as if the albatross entirely ignored the presence of the shark, but on closer observation it was seen that the albatross was keeping tab on the shark's movements, or, in nautical parlance, "kept his weather eye lifting". (The albatross was at the time swimming, not in flight). The albatross never allowed the shark (a small blue one, 5 ft. 6 in. or 6 ft. long) to approach closer than about three feet before he lifted and alighted again some yards away. He also never disputed with the shark the right to a morsel of food they both neared about the same time.

I think the shark never looked on the bird in the light of a meal, for when the albatross was quite still on the water and the shark swimming towards it, the shark never hurried in the least.

The albatross is quite often seen asleep in the day-time on the ocean surface in the conventional position with his head under his wing. If one of the larger sharks then came across him it is quite likely there would be one fewer albatross.

While albatrosses fly on moonlight nights, it seems as if they cannot see very well, for no food thrown over to them at that time ever attracts them, not even a handful of scraps of white paper, a thing that never fails in the day time to attract their attention. Sharks seem to be suspicious of every object floating on the surface. Never have I known one to be tempted to take a hook at night on the surface. Deep down they probably rely on their sense of smell. But a floating albatross would be a more familiar object than a hook, so perhaps the shark might take a chance and rely on his sense of smell only.

Thalassarche chlororhyncha* and *T. chrysostoma—YELLOW-NOSED AND GREY-HEADED ALBATROSSES

These species differ so greatly in appearance from the wandering

albatross that seafarers do not recognize them as albatrosses, but call them mollyhawks. They are, I think, among the most beautiful birds of the southern ocean and there are many more of them than there are of the larger albatrosses. A peculiar feature of their occurrence is that most of the birds are seen in spring and winter, while in summer they have nearly vanished from the ocean.

These birds are usually seen in flocks of two or three, but often they are quite alone. The largest flock I ever saw consisted of about fifty birds. On another occasion I saw forty in nearly the same region and at the same time of year,—northeast of the Falkland islands in autumn. Flocks of thirty and of twenty have also been seen once; fifteen on three occasions, and ten on eight occasions. It is hardly correct to say that they are in flocks at any time, for even if thirty or more be present, they are scattered in all directions from the ship.

Thalassarche melanophrys—BLACK-BROWED ALBATROSS

Although this species is about the same size as the preceding, it may be distinguished as soon as sighted by its snow-white head and neck. It is much more common in the Atlantic and Indian oceans than in the Pacific, only 4 per cent. of the birds seen having been noted between 180° and 90° west longitude.

As in the case of the other species considered, the black-browed albatross is more numerous in the more northern latitudes in the southern winter and vice versa.

The number seen each season varied less than in most of the species under observation.

It has been seen as far north as the 26th parallel in the Atlantic, but in most longitudes it has not been seen nearer the equator than the 36th parallel.

The greatest, least and average wing spread of 10 specimens measured were 7 feet 6 inches, 7 feet, and 7 feet 3 inches, respectively, while the corresponding weights were 8½, 7 and 7¾ pounds.

Phoebastria fuliginosa—CAPE HEN

The name Cape Hen is applied in books to various species of large southern ocean birds but in my experience the bird to which the name is usually applied is a large albatross of brown or greyish brown plumage. Most of the birds which I have recorded under this name undoubtedly belong to the species *Phoebastria fuliginosa* (*P. fusca*), sometimes called the sooty albatross, but as I occasionally observed specimens somewhat lighter coloured than the rest it is likely that my records include observations on the closely related *P. palpebrata* (*P. cornicoides*) or light-mantled sooty albatross. For this reason the figures have been omitted.

There is another large southern ocean bird of nearly the same size and coloration as the albatross mentioned above, namely, the giant petrel (*Ossifraga gigantea*), but its method of flight is so different from theirs that it is noticeable at any distance at which the birds can be seen. The graceful, seemingly effortless flight of the albatross is in strong contrast to the laboured flapping of the petrel. At close range the most noticeable difference apart from the flight is the slender build of the albatross and the thick-set body of the petrel. Then the former's narrow black bill and the latter's large, thick, horn-coloured one will make identification complete at a considerable distance.

***Orsifraga gigantea*—GIANT PETREL; MOTHER CAREY'S GOOSE**

Some of the most obvious differences between this, the largest petrel, and one of the smaller albatrosses which it resembles somewhat in coloration as well as in size, have been alluded to in describing the Cape hen or sooty albatross.

The plumage of this species is mostly brown or greyish brown, but quite often individuals are distinctly grey about the head and neck. The heavy bill is horn-coloured. The legs are set much nearer the centre of gravity of the body than is the case with the albatrosses and this allows them much greater freedom of action on land.

The petrels all seem to prefer the cooler latitudes and this one is no exception. In only two instances in eighteen years was it seen nearer to the equator than the 30th parallel.

My data give little information as to its north and south movements, for in summer they move south of the latitude covered by my observations and are known to be found in vast numbers about the islands and lands south and east of the "Horn", south Georgia, south Shetlands and Graham's land.

There is a belief current amongst seafarers that there is an albatross that is entirely white, but it seems fairly certain that such a bird does not exist. From the time I first began to take notes on the albatrosses I made it generally known on the ship that I would be extremely pleased if any one that saw a white bird of any size would let me know. I made this request each voyage to the southward for about three years before a large white bird was seen "off the starboard bow". Sure enough, it was white, and all white, and a very big bird, but it was not an albatross. It was the rare white variety of the giant petrel.

So I think all reports of an all-white albatross can be traced to the presence of this bird. It is sufficiently rare in latitudes traversed by merchant ships to attract the attention of the most casual observer. Any one having seen such a bird would retain in his memory an impression of a large white bird that was very rare and as its size would increase with

elapse of time as such memories often do, and also every time the incident was related until it was a fourteen-foot albatross that had been seen. The greatest, least and average wing spread of six specimens measured were 7 feet, 6 feet 11 inches, 6 feet 8 inches respectively, while the corresponding weights were 7, 5½ and 6½ pounds.

Following are the records of my observations of these white giant petrels,—May 17th, 1907, 50½S., 121½W. Seen in company with a number of the dark ones, had number of round dark spots on belly; June 5, 1907, 46S., 39W.—Only bird of the species seen at the time; May 2, 1912, 52¼S., 118W.—Only one seen, caught this one; May 14, 1913, 53½S., 81W.—Only one seen, few black or dark spots on under-surface of body, black feet; July 4, 1915, 35S., 6½E.—Only one of the species seen; July 14, 1915, 41½S., 35¼E.—Only one seen; March 31, 1918, 60S., 130W.—Only one seen; April 21, 1918, 50S., 50W.—Only one seen; August 12, 1919, 41S., 30W.—In company with five or six others.

Adamastor cinereus—GREY SHEARWATER

This shearwater dives much more frequently than most of the other species noted. It does not dive from great heights; in fact, it does not dive at all in the sense that gannets and cormorants do. It rather lands on the water in an ungraceful flop and proceeds to swim down after its objective, using its wings under water.

The plumage has a rather glossy appearance, due to the fact that the feathers lie close together but they are not as compact as the feathers of such divers as auks and penguins, but carry a great amount of imprisoned air. When the bird is seen swimming under water on a sunny day the reflections from the air-bubbles give it the appearance of being covered with tiny silver spangles. I have seen it swimming as deep as eighteen or twenty feet after particles of food that were sinking rapidly.

In summer I have never seen these shearwaters north of the 40th parallel, but in winter they move up nearly to the 30th and some were seen in this season north of this parallel.

There seems to be a good deal of seasonal movement east and west. In spring, 93% of the birds seen were in the 90°E.-180-90°W. hemisphere; except for a few specimens seen about Amsterdam island, the Atlantic was found to be practically deserted at this season. Another notable feature observed in the case of these species was the great numbers of the birds seen in autumn in the Pacific.

These birds are usually seen in flocks of four or five and it is rare to see solitary individuals. On three occasions forty have been seen together, and flocks of from twenty to thirty-five on dozens of occasions in the eighteen years.

The average wing spread and weight of six specimens was 4 feet and 2 pounds respectively.

Procellaria equinoctialis—WHITE-CHINNED PETREL

The white gorget-shaped spot on the gular region of this species is easily seen at considerable distances, thus distinguishing it from other birds of nearly the same general coloring and not greatly different in size.

The only fact worthy of note in connection with the seasonal records of these birds is that half of those observed during the year were seen over the oceans in the spring while in autumn practically none were seen. In the latter case it may be they pass south beyond the limits of the observations, but as they are met with in good numbers in the warmer latitudes at other seasons, that hardly explains their entire absence. It looks more as if it were the breeding season, but then the large numbers seen in spring would be more difficult to explain. Solitary members of the species are seen north of the 30th parallel in all seasons except summer. In spring and winter an odd one or two has been met with as far as the 26th parallel, and at the same time—winter—it has been seen in considerable numbers off the Falklands and the Horn, so something more than temperature must govern their movements in latitude.

The distribution of these birds in longitude is different from that of the preceding species. There is one quadrant in which this species is never found, 180-90°W. (New Zealand to within 15 degrees of the west coast of South America). One might say, to all intents and purposes, that it is never seen in the Pacific.

Pterodroma lessoni—WHITE-HEADED PETREL

This petrel is readily distinguished from all the other petrels of which I have kept record. It is characterized by its swift flight and sharp arching of its wings which give it a M-like appearance when the back is presented. It is considerably lighter in colour than the other species, the white head and neck being especially noticeable, even at great distances.

It seldom comes close to vessels, rarely approaching nearer than fifty yards and usually remaining more than five hundred yards away. Specimens are usually seen flying alone; only once in eighteen years, near the Leeuwin, in summer, have twenty been seen together. On three or four occasions six have been met with and there have been about a dozen instances where four have been seen in company. In every other instance they have been met with in pairs and singly, more often singly. It has sometimes been seen feeding with other species, but it does not remain long in such situations, soon wandering off by itself once more. In all my voyages I was able to catch only one.

This petrel appears to have a more restricted north and south range than any of the other species of southern ocean birds considered. During winter, spring and summer they are largely confined to the 40°-50° zone. In autumn they are seen in greater numbers, about half of the total noted having been seen in this season and at this time they are to be found in considerable numbers in the 50°-60° zone as well as in the 40°-50° one.

I have seen reports of great numbers of these birds being found in the Antarctic but only in restricted longitudes.

Prion spp.—WHALE BIRDS

There are several species of these interesting birds found in the southern ocean, but they are so similar in appearance on the wing that I was unable to distinguish them. One of the most striking peculiarities of their flight is that when they are present in large numbers, all the individuals of the flock wheel at the same time, thus they all either present their blue back or white under surface at one time. On a stormy day and under heavy leaden clouds the effect is startling. One instant the whole air is alive with them, the next they have vanished from view, so perfectly does their colouring blend with the leaden sea and sky. There are several species of small sea-shore birds that do the same thing in flight, but the stormy, gloomy conditions under which the whale birds are often seen, and the vast stretches of lonely ocean, lend an atmosphere to the feature that is entirely lacking in the case of the sea-shore birds.

They seem to feed like the Mother Carey chicken (stormy petrel), skimming the minute crustacea from the surface of the ocean without alighting or, apparently, even hesitating in their flight. They seem to be very voracious, for specimens I have obtained always contained all the food their digestive organs would hold.

Whale birds are usually seen in flocks of from forty to fifty and sometimes in their favoured haunts they are seen in flocks of several thousand. On a number of occasions flocks that were estimated at three thousand were seen and once when the air seemed filled with them, five thousand was set down as a very conservative estimate of their number.

These birds favour Marion, Prince Edward, and the Crozet group of islands above all other districts in summer, but in the autumn they have vanished from this district entirely. As the numbers seen within the latitudes covered by the charts have decreased very greatly in other regions as well, it is probable that the greater portion of the birds are in the Antarctic at this season. Although those seen at this time are scattered over most of the Pacific, there were more seen around the Nimrod islands vicinity than elsewhere. Then the winter finds most of them about the eastern shores of Cape Colony and south of it, while in spring they are congregating between the Cape and the island groups of the

Indian ocean before they all move east to islands they favour in summer.

Priocella antarctica—SILVER-GREY PETREL

This is the cleanest-looking of all the southern ocean petrels. Its plumage is soft and fluffy, not like that of many of them with the hard-looking, sleek appearance.

It is difficult to catch on a hook as it generally leaves some of the other species to do the investigating where doubtful objects are concerned. Then, too, its bill is very narrow, and the chances of the hook catching in the bill are much less than in the case of most of the other southern ocean birds. This, combined with the difficulty of overcoming its caution, makes it extremely hard to secure. In contrast to its caution when swimming, is its boldness when flying. With the exception of the Cape pigeon it flies more closely about the vessel than any other southern ocean bird. When flying close along the surface of the sea it will often keep only a foot or two from the ship's side, but when flying about the level of the deck, if there are people in evidence, it is not so bold as the Cape pigeon and keeps some few feet beyond reach.

It is the only species of those of which records were kept, that vanishes completely from the regions covered by the charts for a whole season. During the whole eighteen years the records were kept, not one specimen was seen in the summer.

Much more than half of the birds seen during the year were noted in the autumn. This drops away to thirteen per cent. in winter, and while some twenty-three per cent. are seen in the spring, they are seen in one part of the ocean only.

Except for a few birds seen about New Zealand in autumn, this species is confined to the 180-90° W-0 hemisphere (Pacific) so far as my records are concerned.

This species has never been seen in large flocks. Off the Horn in autumn as many as twenty-five were met with at one time on several different voyages, but that was the only season and place that such a number was seen. The average number seen together is four or five.

It is never seen nearer the equator than the 30th parallel, and only in autumn is it seen north of the 40th.

Daption capense—CAPE PIGEON

This is probably the best known of all the southern ocean birds excepting only the albatross. Vasco de Gama and Magallanes knew it well, and the most blasé, round-the-world tripper that ever draped himself over a liner's rail, displays a temporary interest in this sociable bird, with its pierrot-like markings, when said liner pays a brief visit to these

stormy regions. Often it is the only form of bird life except the albatross that ever attracts the average seaman's attention in those regions, and whose absence and presence he might remark.

He may best be described as a large white pigeon that has been caught in a shower of black paint, and that had finally found a shelter that had left his head and tail out in the shower.

The Cape pigeon is the most fearless, as regards man, of any of the southern birds. It will fly along parallel with the rail of the vessel just out of arm's reach. No noise or commotion on the ship seems to disturb it to any extent. When the ship is lying becalmed it will swim right in under the stern, and if the ship suddenly drops on the swell, and shoots the Cape pigeon several yards away with the splash, he returns almost immediately, giving vent to a stream of strident cackling, a realistic imitation of a modern Xantippe broadcasting the morning moan.

It seems to find pleasure in a petty deception. On deck, if you approach it slowly, it looks quite unconcerned; if you may stand a few feet away it apparently takes no notice; but if you stoop to catch hold of or to pat it, it will squirt an evil-smelling oil all over you, and scutter away cackling in high glee, while you try to remove the odour and retain the clothes.

If you are out in a small boat, it often acts in the same way, letting you get quite close, but if you make any sudden move, it will squirt this fluid at you, and it is no mean shot with it either.

Catharacta antarctica—SOUTHERN SKUA

This is the southern representative of the Great Skua of the north. It is fitting that it should be placed last on our list for it is both a parasite and an outlaw from all the better class of albatross and petrel associations.

The skua can never be mistaken for any other bird of the southern ocean. The plumage, except for the white markings on the upper surface of the wings, is all brown. These markings, at a distance, blend into two comparatively large white spots. As soon as the bird is sighted the almost continuous and rather slow flapping of the wings places it as either the giant petrel or the skua, but long before it is near enough to be recognized by its size, the white spots on the wings loom up in the case of the skua, whereas with the giant petrel the large horn-coloured bill shows up in sharp contrast to its brown plumage.

The skua does not as a rule follow the vessel—a few circles around at various distances, a zigzag or two along the wake where some birds may be picking up food, is the extent of its attention to the ship's presence. If it happens to see a bird picking up food, the skua generally makes a swoop at it so that it may drop it for his benefit. Then he is away on his

wandering over the waters. Even if it is a parasite it does not lack courage for it will attack the smaller albatrosses in the air and force them to alight or disgorge. But on land he is the cock o' the walk, for then even his majesty the wandering albatross and his brother, the royal albatross, are not exempt from the skua's unpleasant attentions. For, however majestic the albatross may be in air or on sea, he is far from dignified in his movements on land, his legs being too far "aft", but the skua has his near "amidships", so can run about quickly while the albatross only waddles. So if the albatross leaves the eggs or young unattended the skua can work his own sweet will with them while the albatross is waddling wildly to the rescue.

Of all the ocean birds that I have had to do with the skua has the greatest hold on life. It has the cat's nine lives and a few extra for good measure. Whenever we desired to keep one of the various birds we caught for either scientific or commercial purposes, a sharp blow on the head usually finished it instantly. Not so the skua. One calm day we were out in a boat trying to capture a white-headed petrel, when a wandering skua was tempted by the bait. As I had never had one to dissect, I thought we might capture this one. It was easily hooked and drawn into the boat, given a sharp rap on the head that we thought was sufficient to kill it, but this only annoyed it, so it was given a regular knockout blow as we certainly had no desire to see it suffer. It fell into the bottom of the boat, apparently dead, but soon revived. Then the second mate, who was pulling stroke oar, grabbed it and gave it a blow sufficient to kill a good healthy ox and wrung its neck. Now it did seem finished, and we devoted our energies to the capture of the white-headed petrel aforesaid. A few moments later the second mate gave a yelp,—the skua had given him a nasty jab in the leg and was scrambling over the gunwale of the boat. We did not try to detain it, for it surely had earned its freedom. It has the vitality of a hero in a motion-picture serial. If it is the temporary abode of some seafarer's spirit it must be possessed of the spirits of the Sakr-el-Bahr, "Hawks-of-the-Sea". Scott's and Shackleton's people killed skuas for food. I wonder how? Bombs, poison gas or boiling oil? If the skua's flesh is in keeping with its hold on life, we need no further evidence as to the vigorous constitutions of the personnel of these expeditions.

More than half the year's birds are seen in summer. Then there is a continuous diminution to the six per cent. that are met with in spring.

On seven occasions in eighteen years I have seen four at once. It is frequently seen in pairs, but solitary individuals are more often seen than any other number. It is seen more often alone than any other southern ocean bird except the white-headed petrel.

TABLE 2.—Seasonal distribution of the albatrosses (*Diomedea* spp.) in latitude and longitude.

| Season | Birds seen | | Percentage Distribution in latitude | | | | Percentage Distribution in longitude | | | |
|--------------|------------|-------------|-------------------------------------|-------|-------|-------|--------------------------------------|--------|--------|------|
| | Num-ber | Per-centage | 20-30 | 30-40 | 40-50 | 50-60 | 0-90 E | 90-180 | 180-90 | 90-0 |
| | | | % | % | % | % | % | % | % | % |
| Spring . . . | 440 | 21 | 5 | 62 | 30 | 3 | 34 | 18 | 8.5 | 39.5 |
| Summer . . . | 1173 | 51 | 0.5 | 28 | 45 | 26.5 | 20 | 13 | 25 | 42 |
| Autumn . . . | 432 | 13 | 3.5 | 36 | 39 | 21.5 | 11 | 29 | 37 | 23 |
| Winter . . . | 385 | 15 | 3 | 54 | 42.9 | 0.1 | 58 | 24 | 9 | 9 |
| The year . . | 2430 | 100 | 2 | 40 | 41 | 17 | 27 | 18 | 21 | 34 |

TABLE 3.—Seasonal distribution of the Yellow-nosed and Grey-headed albatrosses (*Thalassarche chlororhyncha* and *T. chrysostoma* in latitude and longitude.

| Season | Birds seen | | Percentage Distribution in latitude | | | | Percentage Distribution in longitude | | | |
|--------------|------------|-------------|-------------------------------------|-------|-------|-------|--------------------------------------|--------|--------|------|
| | Num-ber | Per-centage | 20-30 | 30-40 | 40-50 | 50-60 | 0-90 E | 90-180 | 180-90 | 90-0 |
| | | | % | % | % | % | % | % | % | % |
| Spring . . . | 303 | 38 | 0.1 | 23 | 56.9 | 20 | 6 | 20 | 19 | 55 |
| Summer . . . | 106 | 8 | 0 | 22 | 72 | 6 | 24 | 41 | 2 | 33 |
| Autumn . . . | 512 | 19 | 0 | 9 | 48 | 43 | 2 | 14 | 40 | 44 |
| Winter . . . | 475 | 35 | 3 | 38 | 58 | 1 | 53 | 21 | 14 | 12 |
| The year . . | 1396 | 100 | 1 | 25 | 57 | 17 | 23 | 21 | 20 | 36 |

TABLE 4.—Seasonal distribution of the Black-browed albatross (*Thalassarche melanophrys*) in latitude and longitude.

| Season | Birds seen | | Percentage Distribution in latitude | | | | Percentage Distribution in longitude | | | |
|--------------|------------|-------------|-------------------------------------|-------|-------|-------|--------------------------------------|--------|--------|------|
| | Num-ber | Per-centage | 20-30 | 30-40 | 40-50 | 50-60 | 0-90 E | 90-180 | 180-90 | 90-0 |
| | | | % | % | % | % | % | % | % | % |
| Spring . . . | 345 | 28 | 0 | 20 | 68 | 12 | 32 | 31 | 5 | 32 |
| Summer . . . | 920 | 30 | 0 | 12 | 46 | 42 | 39 | 9 | 4 | 48 |
| Autumn . . . | 291 | 18 | 0 | 57 | 35 | 8 | 2 | 81 | 9 | 8 |
| Winter . . . | 368 | 24 | 7 | 59 | 33 | 1 | 59 | 30 | 1 | 10 |
| The year . . | 1924 | 100 | 2 | 33 | 48 | 17 | 36 | 32 | 4 | 28 |

TABLE 5.—Showing seasonal distribution of the Giant petrel (*Ossifraga gigantea*) in latitude and longitude.

| Season | Birds seen | | Percentage Distribution in latitude | | | | Percentage Distribution in longitude | | | |
|--------------|-------------|-----------------|-------------------------------------|-------|-------|-------|--------------------------------------|--------|--------|------|
| | Num- ber | Per- centage | 20-30 | 30-40 | 40-50 | 50-60 | 0-90 E | 90-180 | 180-90 | 90-0 |
| | | | % | % | % | % | % | % | % | % |
| Spring . . . | 66 | 26 | 0 | 7 | 51 | 42 | 7 | 9 | 7 | 77 |
| Summer . . . | 91 | 15 | 0 | 0 | 75 | 25 | 18 | 15 | 40 | 27 |
| Autumn . . . | 220 | 30 | 0 | 16 | 52 | 32 | 3 | 32 | 23 | 42 |
| Winter . . . | 128 | 29 | 1 | 34 | 61 | 4 | 29 | 38 | 8 | 25 |
| The year . . | 505 | 100 | 0.2 | 16 | 58 | 25.8 | 14 | 25 | 17 | 44 |

TABLE 6.—Showing seasonal distribution of the Great Grey shearwater (*Adamastor cinereus*) in latitude and longitude.

| Season | Birds seen | | Percentage Distribution in latitude | | | | Percentage Distribution in longitude | | | |
|--------------|-------------|-----------------|-------------------------------------|-------|-------|-------|--------------------------------------|--------|--------|------|
| | Num- ber | Per- centage | 20-30 | 30-40 | 40-50 | 50-60 | 0-90 E | 90-180 | 180-90 | 90-0 |
| | | | % | % | % | % | % | % | % | % |
| Spring . . . | 340 | 19 | 0 | 22 | 74 | 4 | 2 | 16 | 77 | 5 |
| Summer . . . | 252 | 17 | 0 | 0 | 82 | 18 | 34 | 14 | 50 | 2 |
| Autumn . . . | 999 | 51 | 0 | 5 | 52 | 43 | 0 | 23 | 70 | 7 |
| Winter . . . | 228 | 13 | 28 | 57 | 15 | 0 | 17 | 13 | 56 | 14 |
| The year . . | 1819 | 100 | 4 | 14 | 56 | 26 | 8 | 19 | 66 | 7 |

TABLE 7.—Showing seasonal distribution of the White-chinned petrel (*Procellaria equinoctialis*) in latitude and longitude.

| Season | Birds seen | | Percentage Distribution in latitude | | | | Percentage Distribution in longitude | | | |
|--------------|-------------|-----------------|-------------------------------------|-------|-------|-------|--------------------------------------|--------|--------|------|
| | Num- ber | Per- centage | 20-30 | 30-40 | 40-50 | 50-60 | 0-90 E | 90-180 | 180-90 | 90-0 |
| | | | % | % | % | % | % | % | % | % |
| Spring . . . | 414 | 42.5 | 1 | 45 | 54 | 0 | 62 | 7 | 0 | 31 |
| Summer . . . | 524 | 33 | 0 | 20 | 80 | 0 | 59 | 29 | 0 | 12 |
| Autumn . . . | 26 | 0.5 | 4 | 22 | 28 | 46 | 0 | 12 | 0 | 88 |
| Winter . . . | 380 | 24 | 22 | 22 | 27 | 29 | 28 | 15 | 0 | 57 |
| The year . . | 1344 | 100 | 6 | 31 | 56 | 7 | 53 | 16 | 0 | 31 |

TABLE 8.—Showing seasonal distribution of the White-headed petrel (*Pterodroma lessoni*) in latitude and longitude.

| Season | Birds seen | | Percentage Distribution in latitude | | | | Percentage Distribution in longitude | | | |
|--------------|------------|-------------|-------------------------------------|-------|-------|-------|--------------------------------------|--------|--------|------|
| | Num-ber | Per-centage | 20-30 | 30-40 | 40-50 | 50-60 | 0-90 E | 90-180 | 180-90 | 90-0 |
| | | | % | % | % | % | % | % | % | % |
| Spring . . . | 49 | 25 | 0 | 17 | 83 | 0 | 33 | 37 | 16 | 14 |
| Summer . . . | 104 | 50 | 0 | 5 | 89 | 6 | 10 | 31 | 54 | 5 |
| Autumn . . . | 52 | 11 | 0 | 6 | 42 | 52 | 0 | 4 | 61 | 35 |
| Winter . . . | 41 | 14 | 2 | 37 | 57 | 2 | 18 | 48 | 26 | 8 |
| The year . . | 246 | 100 | .5 | 12.5 | 78 | 9 | 16 | 32 | 41 | 11 |

TABLE 9.—Showing seasonal distribution of the Whale birds (*Prion* spp.) in latitude and longitude.

| Season | Birds seen | | Percentage Distribution in latitude | | | | Percentage Distribution in longitude | | | |
|--------------|------------|-------------|-------------------------------------|-------|-------|-------|--------------------------------------|--------|--------|------|
| | Num-ber | Per-centage | 20-30 | 30-40 | 40-50 | 50-60 | 0-90 E | 90-180 | 180-90 | 90-0 |
| | | | % | % | % | % | % | % | % | % |
| Spring . . . | 3643 | 21.5 | 0 | 1.5 | 98 | .5 | 88.88 | 0.04 | 0.08 | 11 |
| Summer . . . | 13462 | 59 | 0 | 0.2 | 83 | 16.8 | 77 | 0.3 | 12 | 10.7 |
| Autumn . . . | 2762 | 10 | 0 | 2 | 59 | 39 | 0 | 45 | 42 | 13 |
| Winter . . . | 3058 | 9.5 | 0 | 68 | 31.9 | .1 | 98.7 | .6 | .2 | .5 |
| The year . . | 22925 | 100 | 0 | 7 | 79 | 14 | 74 | 5 | 11 | 10 |

TABLE 10.—Showing seasonal distribution of the Silver Grey petrel (*Priocella antarctica*) in latitude and longitude.

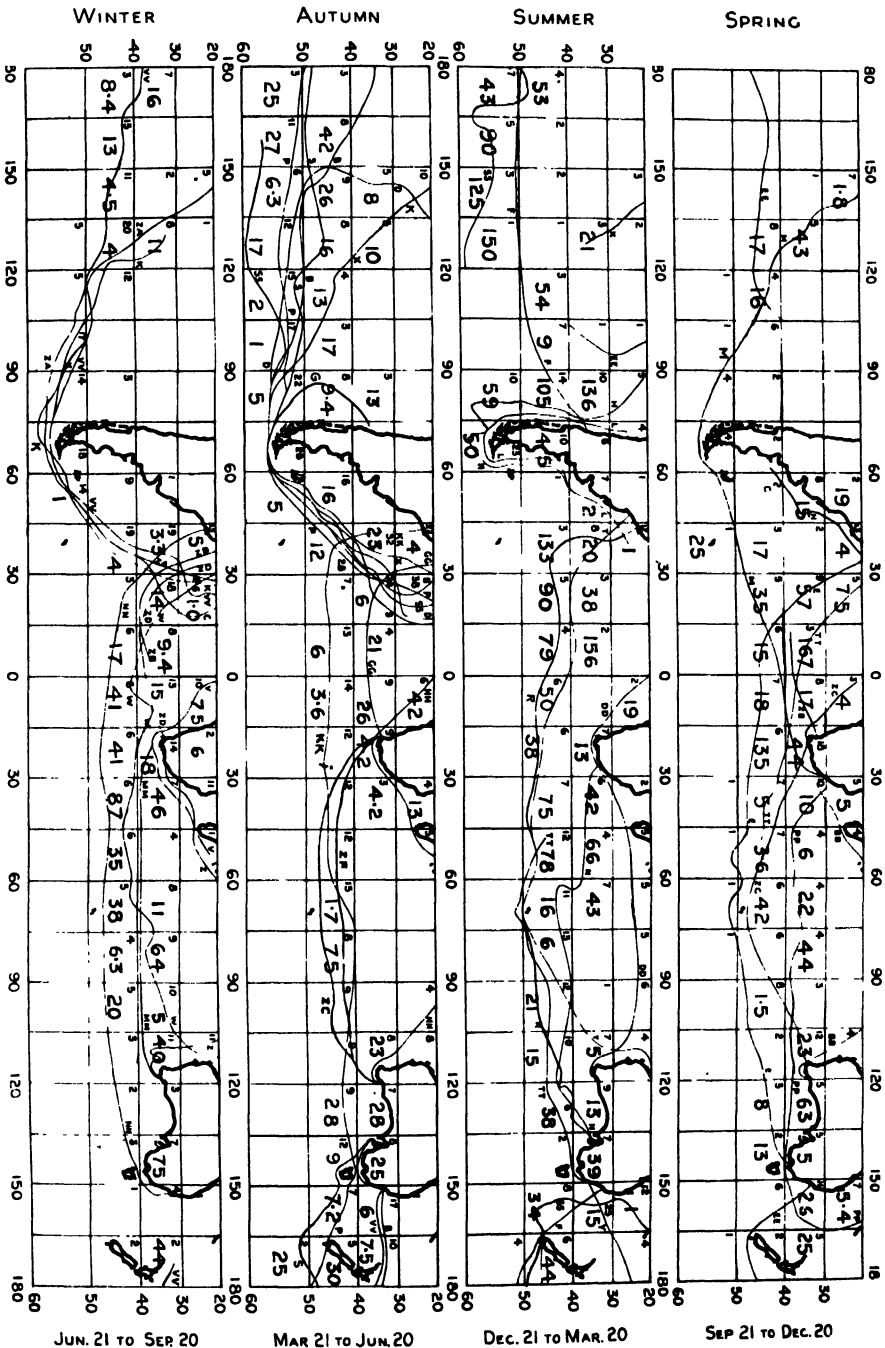
| Season | Birds seen | | Percentage Distribution in latitude | | | | Percentage Distribution in longitude | | | |
|--------------|------------|-------------|-------------------------------------|-------|-------|-------|--------------------------------------|--------|--------|------|
| | Num-ber | Per-centage | 20-30 | 30-40 | 40-50 | 50-60 | 0-90 E | 90-180 | 180-90 | 90-0 |
| | | | % | % | % | % | % | % | % | % |
| Spring . . . | 35 | 23 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 100 |
| Summer . . . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Autumn . . . | 379 | 64 | 0 | 15 | 35 | 50 | 0 | 15 | 6 | 79 |
| Winter . . . | 81 | 13 | 0 | 0 | 15 | 85 | 0 | 0 | 38 | 62 |
| The year . . | 495 | 100 | 0 | 10 | 47 | 43 | 0 | 10 | 9 | 81 |

TABLE 11.—Showing seasonal distribution of the Cape pigeon (*Daption capense*)¹ in latitude and longitude.

| Season | Birds seen | | Percentage Distribution in latitude | | | | Percentage Distribution in longitude | | | |
|--------------|------------|-------------|-------------------------------------|-------|-------|-------|--------------------------------------|--------|--------|------|
| | Num-ber | Per-centage | 20-30 | 30-40 | 40-50 | 50-60 | 0-90 E | 90-180 | 180-90 | 90-0 |
| | | | % | % | % | % | % | % | % | % |
| Spring . . . | 379 | 32 | 0 | 29 | 19 | 52 | 19 | 5 | 15 | 61 |
| Summer . . . | 61 | 2 | 0 | 0 | 100 | 0 | 79 | 21 | 0 | 0 |
| Autumn . . . | 790 | 25 | 0 | 4 | 56 | 40 | 0 | 46 | 9 | 45 |
| Winter . . . | 1071 | 41 | 4 | 33 | 41 | 22 | 36 | 12 | 27 | 25 |
| The year . . | 2301 | 100 | 2 | 24 | 39 | 35 | 22 | 19 | 18 | 41 |

TABLE 12.—Showing seasonal distribution of the Southern skua (*Catharacta antarctica*) in latitude and longitude.

| Season | Birds seen | | Percentage Distribution in latitude | | | | Percentage Distribution in longitude | | | |
|--------------|------------|-------------|-------------------------------------|-------|-------|-------|--------------------------------------|--------|--------|------|
| | Num-ber | Per-centage | 20-30 | 30-40 | 40-50 | 50-60 | 0-90 E | 90-180 | 180-90 | 90-0 |
| | | | % | % | % | % | % | % | % | % |
| Spring . . . | 11 | 6 | 0 | 34 | 66 | 0 | 28 | 55 | 0 | 17 |
| Summer . . . | 106 | 55 | 0 | 24 | 43 | 33 | 26 | 22 | 36 | 16 |
| Autumn . . . | 66 | 23 | 0 | 22 | 78 | 0 | 0 | 56 | 22 | 22 |
| Winter . . . | 51 | 16 | 7 | 62 | 30 | 1 | 38 | 15 | 30 | 17 |
| The year . . | 234 | 100 | 1 | 30 | 50 | 19 | 22 | 31 | 29 | 18 |



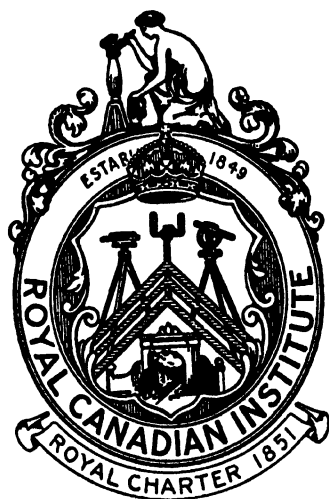
DIXON—SOME OBSERVATIONS ON THE ALBATROSSES AND OTHER BIRDS OF THE SOUTHERN OCEANS

TRANSACTIONS
OF THE
Royal Canadian Institute

No. 42

SEPTEMBER, 1933.

VOL. XIX, PART 2



CALANOID COPEPODA OF BERMUDA

By KATHLEEN GODWIN PINNEY, M.Sc.

McGill University, Montreal

There have been few collections of copepods made near the shores of Bermuda, although the copepod fauna of that district might be expected to yield species hitherto unknown. C. O. Esterly, in 1907, investigated the Calanoids, and has described six species, of which four were formerly unknown, namely, *Lampoidopus marki*, *Pseudocyclops magnus*, *Acartia spinata* and *Acartia bermudensis*.

The material on which the present report is based was collected near Grasmere Cove during February and March, 1926, by Professor A. G. Huntsman, who forwarded it to me for identification. The Calanoids contribute no species which has not been already described by Esterly. The Harpacticoids are distributed among at least four genera, *Harpacticus*, *Idva*, *Porcellidium*, and *Phyllothalestris*. The two former are common throughout the hauls. Several individuals of the *Porcellidium* species were taken on March 4th, in a haul made with a voile net between 6.45 and 6.55 p.m.

There was only one individual of *Phyllothalestris* sp. This agreed with Sars' genus; but, as the one specimen was unfortunately not mature, its specific identification must be postponed till further investigations have been made in the Bermuda region. The other Harpacticoids are not as yet finally assigned to their respective species.

Among the Calanoids, the occurrence of *Lampoidopus marki* in Grasmere Cove (March 3rd, 11.30-11.40 p.m.) is noteworthy. Esterly found this species in a cave in the small island opposite the bathing beach on Agar's island, where the Bermuda Biological Station is situated. The copepod was associated with the shade coral, *Agaricia fragilis*, which, in the Agar's island region, is confined to this same cave. There is no doubt of the identity of the present specimen with Esterly's species, as the wide, thick rostrum and remarkable form of the left fifth foot in the male are unmistakable characteristics.

All the Calanoids are admirably figured and described in Esterly's paper, which may be found in the "Contributions to the Bermuda Biological Station", vol. 2, 1907-1912.

The one Cyclopoid, *Oithona nana*, is described and figured in "Nordisches Plankton" Bd. 8, Copepoden, by Dr. P. J. van Breemen.

The following tables comprise the enumeration and distribution of the Calanoids and *Oithona*.

1. Feb. 16, 6.43-6.48 p.m.
Calanopia americana Dahl—1 (female)
Acartia bermudensis Esterly—1 (male)
Oithona nana Giesbrecht—2
2. Feb. 17, 11.13-11.23 p.m.
Calanopia americana—7 (2 females, 2 males, 3 immature)
Acartia bermudensis—5 (3 males, 2 immature)
The *Phyllothalestris* occurred at this haul.
3. Feb. 17, 11.45-11.55 p.m.
Calanopia americana—1 (female)
Acartia bermudensis—9 (3 females, 4 males, 2 immature)
4. Feb. 19, 6.05-6.15 a.m.
Calanopia americana—2 (1 female, 1 immature)
Acartia bermudensis—3 (2 males, 1 immature)
5. Mar. 3, 8.10-8.20 p.m. Tow A.
Calanopia americana—203 (98 females, 43 males, 62 immature)
Acartia bermudensis—6 (5 females, 1 male)
Oithona nana—1
6. Ibid. Tow B.
Calanopia americana—46 (29 females, 13 males, 4 immature)
Acartia bermudensis—1 (female)
Acartia spinata Esterly—5 (3 males, 2 females)
7. Mar. 3, 11.30-11.40 p.m. Tow A.
Calanopia americana—12 (6 females, 3 males, 3 immature)
Acartia bermudensis—1 (male)
8. Ibid. --n Tow B.
Calanopia americana—6 (3 females, 1 male, 3 immature)
Acartia bermudensis—3 (males)
Lampoidopus marki Esterly—1 (male)
9. Mar. 4, 6.45-6.55 p.m.
Calanopia americana—103 (26 females, 19 males, 58 immature)
Acartia bermudensis—11 (5 females, 3 males, 3 immature)
Oithona nana—3
10. Mar. 5, 5.15-5.25 a.m. Tow A.
Calanopia americana—12 (7 females, 3 males, 2 immature)
Acartia bermudensis—2 (1 female, 1 male)
Oithona nana—2

11. Ibid. Tow B.
Calanopia americana—21 (13 females, 3 males, 5 immature)
Acartia bermudensis—3 (1 female, 2 males)
12. Mar. 5, 8.10-8.20 a.m. Tow A.
Oithona nana—2
13. Ibid. Tow B.
No Calanoids.

GEOLOGICAL SECTION IN CROWSNEST PASS, ROCKY MOUNTAINS, CANADA

By P. S. WARREN

INTRODUCTION

Crowsnest pass, situated in the Canadian Rockies about 50 miles north of the international boundary, forms an easy means of communication between the Plains region of Alberta and Elk River valley in British Columbia. The elevation of the pass at Crowsnest on the divide between Alberta and British Columbia is 4,449 feet above sea level. The Canadian Pacific Railway Company have long since taken advantage of the fairly easy grade in the pass to build a branch line through the mountains at this point and more recently a motor road has been constructed through the pass, giving easy access to any part of the surrounding area.

In spite of the ease with which the district may be entered, no detailed geological work has been attempted except in those areas where coal seams are being exploited. In particular, no attempt has been made to study the area as a whole and no section through the Rockies has ever been constructed at this latitude. It was with the purpose of rectifying this deficiency that the writer spent from two to three weeks in Crowsnest pass during the summer of 1932 studying particular sections. In so short a space of time no detailed work could be attempted. Investigations were carried out largely in the areas between the coal basins, which are underlain, to a great extent, by Palaeozoic rocks. By means of this information and the results of geological work in the coal areas, a preliminary section was constructed from the front range (Livingstone) to Elk river. Certain stratigraphic problems were investigated also and more definite information was obtained regarding the Palaeozoic succession.

The writer wishes to acknowledge the many courtesies extended in the field by Messrs. L. Telfer and C. L. White of the Consolidated Mining and Smelting Co. of Canada and Dr. B. R. MacKay of the Canadian Geological Survey.

PREVIOUS WORK

The earliest geological work of importance in the Crowsnest area was that of Dawson¹ who traversed the pass in a general reconnaissance of

¹Dawson, G. M., Preliminary report of the physical and geological features of that portion of the Rocky mountains between latitudes 49° and 51° 30': Geol. Surv., Can., Ann. Rept. 1885, pt. B, pp. 65-79. 1886.

the southern Rockies. He was followed, shortly, by McEvoy² and Leach³, whose work was confined chiefly to the investigation of coal areas. Rose⁴ followed Leach in the study of the Blairmore region and produced a map which was the basis for all later work in the area. About the same time McLearn⁵ did some careful stratigraphic work on the Fernie and Kootenay formations. Later, McLearn⁶ and Buckman⁷ described the fauna of the Fernie shale in the Blairmore area. In 1927 Warren made a preliminary study of some of the sections of Palaeozoic rocks in the pass⁸ and later⁹ described a fauna from the lower part of the Fernie shale in the Crowsnest Fernie area. About the same time MacKay¹⁰ commenced an intensive study of some of the coal areas of the pass and also the Palaeozoic-Mesozoic boundary in the eastern area. Mackenzie¹¹ has also discussed the general features of the district and investigated especially the Crowsnest volcanic member of the Cretaceous.¹²

GENERAL GEOLOGY

The rocks exposed in Crowsnest pass range in age from Devonian to Upper Cretaceous. The Palaeozoic rocks, which form the backbone of the principal ranges, are mainly limestones, with occasional shale beds. The Mesozoic formations are, on the whole, more incompetent and usually underlie the valleys between the limestone ranges. They are

²McEvoy, J., Geol. Surv., Can., Ann. Rept. for 1900, pt. A, pp. 85-95.

³Leach, W. W., Geol. Surv., Can., Ann. Rept. for 1901, pt. A, pp. 69-81. Ann. Rept. for 1902-3, pt. A, pp. 169-181. Sum. Rept. for 1911, pp. 192-200.

⁴Rose, B., Geol. Surv., Can., Map No. 1584, 1915, and Crowsnest and Flathead coal areas, British Columbia: Sum. Rept. for 1917, pt. C, pp. 28-35. Also, Structure in the Crowsnest area: Trans. Can. Inst. Min. & Met., Vol. 27, 1924.

⁵McLearn, F. H., Jurassic and Cretaceous, Crowsnest pass, Alberta. Geol. Surv., Can., Sum. Rept. 1915, pp. 110-112.

⁶McLearn, F. H., New pelecypods from the Fernie formation of the Alberta Jurassic: Roy. Soc. Can., Trans., Vol. 18, sec. 4, pp. 39-61, 1924.

⁷Buckman, S. S., Jurassic Ammonoidea: Nat. Mus., Can., Bull. 58, pp. 1-27, 1929.

⁸Warren, P. S., The Palaeozoics of Crowsnest pass, Alberta: Roy. Soc. Can., Trans., Vol. 22, sec. 4, pp. 109-119, 1928.

⁹Warren, P. S., A Lower Jurassic fauna from Fernie, British Columbia: Roy. Soc. Can., Trans., Vol. 25, sec. 4, pp. 105-111, 1931.

¹⁰MacKay, B. R., Corbin coal field, British Columbia; Geol. Surv., Can., Sum. Rept. 1930, pt. A, pp. 154-179, 1931. also The Mesozoic-Palaeozoic contact and associated sediments, Crowsnest district, Alberta and British Columbia: Geol. Surv., Can., Sum. Rept., 1931, pt. B, pp. 1-25, 1932.

¹¹Mackenzie, J. D., Historical and structural geology of the southern-most Rocky mountains of Canada: Roy. Soc. Can., Trans., Vol. 16, sec. 4, pp. 97-132, 1922.

¹²MacKenzie, J. D., The Crowsnest volcanics: Geol. Surv., Can., Museum Bull. No. 4, 1914.

composed largely of shales and sandstones with occasional conglomerate beds. The heavy sandstone beds of the Cretaceous sometimes form outstanding topographic features such as Sparwood ridge to the east of Elk river. Such features, however, are never so sharply defined or so conspicuous as those formed by the Palaeozoic limestones.

The sequence represented by this succession of rocks is remarkably complete, the Permian alone being absent. Some of the systems, however, are represented only by partial successions such as the Devonian and Triassic, whereas other systems show a very complete representation. On the whole, the section representing any system is remarkably thick whether the whole system is present or not, thus proving that the deposition in the Rocky Mountain geosyncline was very rapid in the Crowsnest area. Another point to be noted regarding the deposition of sediments in the area is that the formations thicken toward the west, from which direction the chief supply of sediment appears to have been derived. This statement may not hold true for the Devonian as the rocks of that system are fully exposed in one range only. In the Jasper area to the north, the Devonian tends to thicken towards the east and the same applies to a certain extent in the Banff area. It is probable that physiographic conditions along the Cordilleran geosyncline changed considerably at the end of Devonian time.

A detailed description of the various formations exposed in the area will be found in the section on stratigraphy. The formations present are listed in the table given below.

STRUCTURAL GEOLOGY

The structure in Crowsnest pass is more open than in other major passes through the mountains, the Cretaceous rocks being the most prominent group exposed in the section. In Kicking Horse and Yellow-head passes, Cretaceous rocks are exposed in only one major fault block west of the front range, while the Palaeozoics form the dominant part of the section. In Crowsnest pass the Cretaceous rocks are exposed right to the west end of our section on Elk river and show a surprisingly small amount of deformation. The reason for this difference in structure in Crowsnest pass must be sought in a far wider area than that covered by the writer in studying this section.

The main structural features in the area are the Palaeozoic fault blocks. As other structures are largely subservient to them, it is best to consider these structures first.

The Palaeozoics are exposed in three ranges :—Firstly, the Front range including the Livingstone and Bluff-Turtle mountain range; secondly,

TABLE OF FORMATIONS IN CROWSNEST PASS

| System | | Formation | Thickness | Description |
|---------------|---------------|--|----------------------|---|
| Cretaceous | | Allison | 2000 ft. + | Light grey ss. and green shales |
| | | Alberta* | 2800 ft. ± | Dark grey shale, subordinate ss. |
| | | Crowsnest vol. | 1150 ft. — | Tuffs, agglomerates and flows |
| | | Blairmore | 2000 ft. ± | Grey and green ss., shale and conglomerate |
| | | Kootenay | 600 ft. + | Sandstone, shale and coal-seams |
| Jurassic | | Fernie | 800 ft. + | Dark grey sandy and light grey calcareous shales. Some sand |
| Triassic | | Spray River | 50-350 ft. | Dark grey thin-bedded sandy dolomites and limestones |
| Carboniferous | Pennsylvanian | Rocky Mountain Quartzite | 350-800 ft. | Sandy dolomites, limestones, quartzites and chert |
| | Mississippian | Rundle | 1600-5300 ft. | Grey limestone with chert |
| | | Banff | 1200 ft. ± | Black shale and argillaceous limestone with chert |
| Devonian | | Minnewanka upper part lower part | 1200 ft. 1675 ft. | Dark grey massive limestone Dolomites, limestone and shale |

*Colorado of earlier authors.

Crowsnest range including Crowsnest Lake mountain, Mt. Phillips and Sentry mountain; and lastly, Erickson ridge. The front range will be discussed first. This range is really composed of two ranges lying "en echelon", Livingstone range lying to the east and north of Bluff-Turtle mountain range. Livingstone range plunges to the south and its limestones are not exposed in the pass. Bluff-Turtle mountain range plunges to the north, the limestones disappearing beneath the later sediments a little north of the pass. Our section was so placed as to cut both limestone ranges where they overlap.

The structure of Livingstone range is that of a fault block thrust to the east over Cretaceous sediments. The fault block displays two well-defined anticlines, both overturned to the east. There was no opportunity of studying the character of the fault in front of this thrust. It is well shown in the battery of sections accompanying the Blairmore

map as interpreted by Leach and Rose.¹³ The structure of the range is well shown on Rock creek pass, a few miles to the north-east of the town of Frank.

The Bluff-Turtle mountain range is a comparatively simple structure. It represents an anticline overturned to the east with a fault of moderate throw at the front. As exposed in the pass, the east limb of the anticline has been largely eroded, showing the centre of the fold. The structure between Livingstone range and Bluff-Turtle mountain range is synclinal.

The second limestone range including Sentry mountain, Crowsnest Lake mountain and Mt. Phillips will be designated in this paper the Crowsnest range and the section of rocks included in it, the Crowsnest section. In the pass, the range represents a thrust fault block with the strata dipping to the west with remarkable regularity at an angle of about 45 degrees. The angle of the fault is apparently very low as shown by the Palaeozoic outlier called Crowsnest mountain resting on Cretaceous strata more than two miles in front of the main range. The angle of the fault between these two points cannot exceed 15 degrees. No further evidence relating to the angle of the fault was obtained and no attempt was made to portray this fault with any accuracy in the accompanying section.

The third limestone range, Erickson ridge, lies just to the west of Crowsnest range. According to Mr. Telfer, the range represents a rather complicated anticlinal structure. In the pass this structure is not shown, only the east limb of the anticline being present, the west limb being faulted out. The east limb is slightly overturned and broken by two faults so closely placed that they are shown as one in the accompanying section. The structure between Crowsnest range and Erickson ridge is synclinal. Erickson ridge plunges to the south and the limestones disappear a short distance south of the pass.

The structure of the Mesozoic rocks between the Palaeozoic limestone ranges was not studied in detail and most of the structure shown in the eastern basin between the front range and Crowsnest range was taken directly from Rose's Blairmore map. In this basin the Cretaceous is represented in three fault blocks, becoming successively broader toward the west and exposing successively higher beds in that direction. The Crowsnest range is faulted against the Allison formation, the highest Cretaceous exposed in the section. The other large Cretaceous basin lies west of Erickson ridge. It assumes the form of a broad syncline the east limb of which is faulted against the Palaeozoics in Erickson ridge. The structure appears, in a brief survey, to be remarkably regular, but is

¹³Blairmore map, No. 1584.

undoubtedly complicated by minor faulting and folding. The syncline is broken, however, by one structure of major importance which crosses the pass in the neighbourhood of Michel. The character of this structure is not known and is indicated on the accompanying section merely by a fault.

In general terms, the structure through Crowsnest pass is more typical of the foothills than of the mountains. This is especially true of the area east of Crowsnest range. It would probably be a more correct structural diagnosis to consider Crowsnest range the front range and the Livingstone-Bluff mountain group an outlier or spur. To arrive at any correct interpretation of the structure, however, would require an intensive study of a wide area, especially to the south of Crowsnest pass. This will be the work of the future.

STRATIGRAPHY

Devonian

Minnewanka formation. Devonian beds are exposed in two of the three Palaeozoic ranges and in only one, the Crowsnest range, can they be studied in any detail. At Blairmore, the uppermost Devonian limestones are exposed in the centre of the fold but their position admits of only a cursory study. The Crowsnest range section, on the other hand, is well exposed along the railway which cuts across some of the main spurs of Crowsnest Lake mountain, giving fresh exposures of part of the Devonian succession. Some of the beds in the lower part of the section are obscured by talus from the mountain.

In the Banff area, the name Minnewanka limestone is applied to the whole succession of Devonian beds. In the Crowsnest section it is proposed to use the same name, but the lower part of the succession differs from the Banff section in the presence of shales and shaly limestone. A section of the Minnewanka formation on Crowsnest Lake mountain, rather roughly measured, is given below:—

Overlying formation:—Banff shale.

1200 ft. Dark grey, massive limestone. Fossils.

300 ft. Thin-bedded, rubbly, dark grey to light grey sometimes cream to white-weathering limestone and dolomite.

25 ft. Rubbly, dark brown dolomite.

75 ft. Medium-bedded, hard, grey limestone.

470 ft. Greenish-grey, nodular, shaly limestone. Fossils.

400 ft. Dark shale, mostly covered.

400 ft. Medium- to thick-bedded, grey, crystalline dolomite; dark, saccharoidal dolomite and grey limestone.

Fault contact with Cretaceous.

This section appears to be very similar to one measured by Kindle on Roche Miette in the Jasper area.¹⁴ Some of the beds in the two areas show a remarkable similarity. This is especially true of the 470 feet of greenish-grey, nodular, shaly limestone of the Crowsnest section which is identical in lithological character and fauna with the beds on Roche Miette named zone 3 by Raymond.¹⁵ It is interesting to note this similarity of beds in areas over 250 miles distant, especially as similar beds have not been observed in intervening areas.

On the other hand, the upper part of the Minnewanka remains remarkably constant both in lithological character and contained fauna throughout the mountains. The massive, dark grey to black type of limestone, weathering to a light grey colour and generally breaking up into rubbly fragments is sufficient to identify this member of the formation without reference to the contained fauna. Fossils, on the whole, are scarce, but can always be obtained by diligent search. Specimens collected by the writer from the upper part of the Minnewanka in the Crowsnest area are enumerated below:—

Productella coloradoensis Kindle, *Productella coloradoensis* var. *plicata* Kindle, *Camarotoechia horsfordi* (Hall), *Pugnax pugnax* (Martin). *Spirifer whitneyi* Hall, *Spirifer whitneyi* var. *animasensis* Girty, *Spirifer parryanus* Hall?, *Athyris angelica* (Hall), *Aviculopecten fasciculatus* Hall?, *Euomphalus eurekensis* Walcott.

This is the *Spirifer whitneyi* fauna, the uppermost Devonian fauna of the Rocky mountains, and can always be collected in the upper part of the Devonian succession.

The only other fauna obtained from the Devonian was collected from the greenish-grey, nodular, shaly limestone in the lower part of the Minnewanka. This fauna was mentioned, in part, by the writer in 1928¹⁶ and was considered probably Middle Devonian in age. The finding of a similar fauna at Jasper together with undoubted Naples species¹⁷ demonstrates its Upper Devonian age and such findings are substantiated by additional collections obtained during the present study. The total fauna collected from this bed in the Crowsnest section is given below:—

¹⁴Kindle, E. M., The succession of fossil faunas in the eastern part of Jasper park: Am. Jour. Sci., Vol. 18, p. 180, 1929.

¹⁵Raymond, P. E., Palaeozoic formations in Jasper park, Alberta: Am. Jour. Sci., Vol. 20, p. 295, 1930.

¹⁶Warren, P. S., The Palaeozoics of Crowsnest pass: Roy. Soc. Can., Vol. 22, sec. 4, pp. 109-119, 1928.

¹⁷Allan, J. A., Warren, P. S., Rutherford, R. L., A preliminary study of the eastern ranges in Jasper park, Alberta: Roy. Soc. Can., Trans., Vol. 26, sec. 4, pp. 245-248.

Diphyphyllum colemanense Warren, *Lingula spatulata* Vanuxam, *Schizophoria striatula* (Schlotheim), *Stropheodonta inequistriata* (Conrad), *Chonetes* cf. *deflecta* Hall, *Productella hallana* Walcott, *Leiorhynchus albertense* Warren, *Gypidula comis* (Owen), *Gypidula* cf. *lotis* Walcott, *Pugnax pugnus* (Martin), *Atrypa reticularis* (Linn.), *Atrypa missouriensis* Miller, *Atrypa spinosa* Hall, *Atrypa spinosa* var. *deflecta* Warren, *Spirifer jasperensis* Warren, *Cyrtia?* *rockymontana* Warren, *Platyceras carinatum* Hall.

The occurrence of *Spirifer jasperensis* in this collection is undoubtedly sufficient to correlate the fauna with the *Spirifer jasperensis* fauna of Naples age in Jasper park where this *Spirifer* occurs so abundantly in some localities.¹⁸ Other species common to the two faunas are:—*Diphyphyllum colemanense*, *Schizophoria striatula*, *Chonetes deflecta*, *Productella hallana*, *Atrypa missouriensis*, *Atrypa spinosa* and *Cyrtia?* *rockymontana*. In Jasper park, such diagnostic Naples forms as *Buchiola retrostriata*, *Baculites aciculum* and *Manticoceras* cf. *oxy* occur with *Spirifer jasperensis* and the Naples age of the Crowsnest fauna is further attested by the presence of *Lingula spatulata*.

The occurrence of the Naples fauna in other parts of the mountains has not as yet been reported but it is probably represented in part by a fauna obtained by the writer at Banff from the lower part of the Minnewanka limestone.¹⁹ This fauna was considered at the time to be Middle Devonian in age though the evidence was not convincing. The *Diphyphyllum* which characterizes that collection is undoubtedly *D. colemanense*. Other species in common include *Chonetes deflecta* and *Atrypa missouriensis*. The form listed from Banff as *Favosites limitaris?* occurs also in the Naples fauna in the Jasper area where the specimens are better preserved and where they have been identified by the writer as *Cladopora* sp. undet. It seems evident from our present knowledge of the *S. jasperensis* fauna that there is little evidence for considering the Banff fauna referred to above as Middle Devonian in age and that its correlation with the Naples fauna would be justified.

Whether Middle Devonian occurs in the Crowsnest section is not known. There are about 800 feet of strata below the beds containing the *Spirifer jasperensis* fauna and some part of this succession may well represent Middle Devonian time.

Carboniferous

Banff shale. Like the Devonian strata, the Banff shale is represented only in the Blairmore and Crowsnest sections. In the Blairmore section

¹⁸Allan, Warren and Rutherford, loc. cit.

¹⁹Warren, P. S., Banff area, Alberta: Geol. Surv., Can., Mem. 153, p. 17, 1927.

only the upper part of the formation may be studied but in the Crowsnest section the whole formation is well exposed and easily accessible along the railway.

In its general features the formation is similar to the typical development at Banff and also at Jasper. The lower part of the formation is a thin-bedded, black shale 150-200 feet thick which lies with apparent conformity on the Minnewanka limestone. The division between the two formations is, however, very abrupt. This lower division of the Banff shale has always failed to yield identifiable fossils. The black shale grades above into a calcareous shale and finally into argillaceous limestone. In both sections in Crowsnest pass this upper division is replete with chert nodules and stringers of chert, thus differing from other sections of the formation studied in the mountains. It differs also in that the upper division appears to be absolutely barren of fossils whereas in all other sections studied by the writer it proved to be the most fossiliferous horizon in the Palaeozoic sequence. The fauna that usually occurs at this horizon is mostly Kinderhook in age. Why it fails in this area is uncertain. The nearer shoreline conditions as shown by the presence of so much chert seems to be an insufficient reason for its absence.

The upper division of the Banff shale is about 1,100 feet thick and grades almost imperceptibly into the overlying heavy limestone beds of the Rundle formation.

Rundle limestone. In the Banff area the Rundle limestone is about 2,400 feet thick; in the Jasper park section it is much less, being at the most not more than 1,000 feet in thickness. In Crowsnest pass the whole formation may be measured in the Blairmore section and in the Crowsnest section and the upper part of the formation is exposed in Erickson ridge section. At Blairmore the Rundle measures 1,600 feet but it thickens greatly to the west as the formation is about 5,300 feet thick in the Crowsnest section. In the Erickson ridge section over 2,000 feet of Rundle is exposed, the lower part of the formation being faulted out.

The discrepancy in the thickness of the Rundle in the Blairmore and Crowsnest sections is probably not due to non-deposition or erosion at the top of the formation in the former area. There seems to be no break between the Rundle and the overlying Rocky Mountain quartzite at any point where the contact has been observed. Faunal horizons are of little value in proving or disproving the point as the Blairmore section is remarkably unfossiliferous. There is, however, an excellent faunal correlation between the Crowsnest section and the section at Banff where the Rundle is less than half the thickness of the formation as exposed at Crowsnest. It is believed, therefore, that conditions favoured a heavier

precipitation of limestone toward the west in the Rocky Mountain geosyncline in the Crowsnest area.

The Rundle formation consists of a monotonous succession of thick to massive limestone beds, generally light grey and coarse grained but occasionally dark grey and fine grained. At the top, about 300 feet of buff-weathering, thin-bedded, fine grained beds are included in the formation. With the exception of these latter beds, the formation cannot be divided into definite lithologic units. The upper part of the formation is, in general, finer grained than the lower part.

Three different faunas were obtained from the Rundle limestone. The first was collected in the lower part of the formation between 300 and 1,000 feet from the bottom. Occasionally a bed contains fossils in some abundance but the massive character of the limestone prohibits the collection of good specimens. Many of the specimens collected were obtained from talus but the horizon from which the fossils came was never in doubt. The following species were collected from this horizon:—*Pentremites* sp. undet., *Polypora* cf. *biseriata* Ulrich, *Productella concentrica* Hall, *Productus viminalis* White?, *Dielasma* cf. *formosa* Hall, *Spirifer centronatus* Winchell, *Spirifer banffensis* Warren?, *Spirifer rundlensis* Warren, *Spirifer* cf. *rostellatus* Hall, *Spirifer* cf. *tenuicostata* Hall, *Spirifer* probably new, *Brachythyris suborbicularis* Hall, *Syringothyris textus* (Hall)?, *Composita humilis* Girty?, *Capulus equilateralis* (Hall)?, *Orthonychia* cf. *acutirostrata* Hall, *Igoceras* sp. undet.

The majority of this list are definite Keokuk forms or closely allied species. Two of the above species, *S. rundlensis* and *S. banffensis* were collected and described from a similar horizon in the Banff area where they were found associated with Keokuk forms. Some of the species suggest higher or lower horizons but this is not surprising considering the thick section of beds from which the fauna was collected.

The writer has observed this fauna in several localities in the Canadian Rockies and always at the same horizon in the Rundle. Its persistence is noteworthy and it is suggested that it be known as the *Spirifer rundlensis* fauna.

About 3,000 feet above the base of the Rundle, the second fauna appears. We will call this the *Lithostrotion* fauna, on account of the prevalence of that genus. Between the *Spirifer rundlensis* zone and the *Lithostrotion* zone no recognizable fossils were collected. This barren zone in the middle of the Rundle was also noted in the Banff section. At Banff the *Lithostrotion* zone was nearer the top of the formation but considering the discrepancy in thickness of the formation in the two areas this is not surprising. The fauna collected from the *Lithostrotion*

zone contain the following species:—*Lithostrotion whitneyi* Meek, *Lithostrotion pennsylvanicum* Shimer, *Lithostrotion banffense* Warren, *Syringopora aculeata* Girty, *Syringopora surcularia* Girty, *Menophyllum?* sp. undet., *Straparolus?* sp. undet.

Lithostrotion whitneyi is known to occur at lower horizons in other sections but the other two species of the genus are confined to this horizon so far as the writer's observations are concerned. The two species of *Syringopora* were both described from the Madison limestone and probably from a lower horizon than we are dealing with here. All the species of *Lithostrotion* closely resemble species found in the Lower Carboniferous of Europe.

The bed from which these fossils were collected is more resistant to erosion from the strata above and below, thus giving the *Lithostrotion* bed a considerable prominence in the section. Above the *Lithostrotion* zone occur about 1,500 feet of limestone which is soft and easily eroded, producing a depression on the back slope of Crowsnest Lake mountain. The only fossils collected in these beds were poorly preserved specimens of a *Linoproductus*. These soft beds are followed by about 350 feet of a more resistant type of limestone which forms the prominent hill to the east of Crowsnest station. This horizon is fossiliferous and the following species were collected:—*Lophophyllum* sp. undet., *Triplophyllum* sp. undet., *Campophyllum?* sp. *Pentremites conoideus* Hall, *Pentremites* cf. *godoni* DeFrance, *Orthotetes kaskaskiensis* (McChesney), *Chonetes loganensis* H. & W., *Linoproductus ovatus* (Hall), *Productus* cf. *keokuk* Girty, *Productus richardsi* Girty, *Pustula biseriata* (Hall)?, *Pustula* cf. *punctata* (Martin), *Diapragmus elegans* (N. & P.), *Girtyella turgita* (Hall), *Spirifer* cf. *pellensis* Weller, *Martinia* cf. *lata* Girty, *Eumetria verneuili* Hall, *Cliothyridina hirsuta* (Hall), *Composita trinucula* (Hall), *Composita sulcata* Weller.

Most of the fossils listed above are well known Upper Mississippian species of the Mississippi valley section, mainly Salem and Chester forms. *Productus richardsi* and *Martinia lata* are species described by Girty from the Brazer limestone of Idaho.²⁰ In discussing the fauna of the Brazer limestone, Girty mentions the occurrence of two faunas, one of Spergen and one of Chester affinities.²¹ The fauna listed above is practically all found in the Brazer limestone and appears to be a mixture of the two faunas of that formation. It is proposed, therefore, to correlate the

²⁰Girty, G. H., Description of Carboniferous and Triassic fossils. Appendix in Mansfield, G. R., Geography, geology and mineral resources of southeastern Idaho: U.S.G.S., Prof. Pap. 152, 1927.

²¹Girty, G. H., loc. cit., p. 63, et seq.

upper part of the Rundle with the Brazer limestone. It is notable that the Brazer also contains *Lithostrotion* so our *Lithostrotion* zone should probably be included in the correlation.

In discussing the correlation of the faunas of the upper part of the Rundle in the Banff area, the writer noted its resemblance to the fauna of the Brazer limestone.²² The fauna of the Brazer was not well known at that time or the correlation would have been urged more strongly. Most of the fauna in the Banff area was collected from the very uppermost beds of the Rundle and showed more affiliation with the Chester than with the Salem limestone. The large *Spirifer* which occurs so abundantly in the upper beds of the Rundle at Banff, identified by the writer as *S. cf. arkansanus*, is very closely allied, if not identical with, Girty's *Spirifer brazerianus* from the Brazer.

There appears to be no definite Pennsylvania elements in the fauna of the upper Rundle in Crowsnest pass. The form listed as *Pustula cf. punctata* may be a Pennsylvanian form but it is not sufficiently well preserved to make the determination definite. The specimen listed as *Spirifer cf. pellensis* could, with equal propriety be referred to the Pennsylvanian form *Spirifer opimus*. The resemblance between these two species is quite remarkable and with poorly preserved material it is doubtful if they can be distinguished.

The corals of this zone have not been studied. Cup corals are very abundant but internal structures are seldom sufficiently well preserved for accurate diagnosis.

The upper 300 feet of Rundle consisting of buff-weathering thin-bedded limestone yielded the writer no fossils. A specimen obtained from this bed by Mr. C. E. White was identified by the writer as *Productus inflatus* McChesney, a typical Chester form.

Rocky Mountain quartzite. The Rundle limestone is overlain, apparently conformably, by a succession of medium-bedded, grey or buff-coloured dolomites, sandstones or sandy dolomites with a considerable development of chert nodules and a few quartzite beds, especially in the upper part. This formation is known as the Rocky Mountain quartzite. It is exposed in all the limestone ranges. In Livingstone range and Turtle mountain it attains a thickness of about 350 feet with a chert conglomerate marking the top of the formation. In the Crowsnest section it has a thickness of about 800 feet. The chert conglomerate is not present but a thin layer of nodular phosphate occurs in the uppermost beds. On Erickson ridge the formation is faulted and the total thickness is unknown.

²²Warren, P. S., Banff area, Alberta: Geol. Surv., Can., Mem. 153, p. 34, 1927.

To the west of Elk river the Rocky Mountain quartzite thickens to 1,900 feet according to information received from Mr. Telfer.

No fossils were obtained from the formation by the writer but in the Banff and other areas it holds a Pennsylvanian fauna.

Triassic

Spray River formation. The Spray River formation is present in all the limestone ranges, lying above the Rocky Mountain quartzite. It was identified through its lithological character and stratigraphic position. The formation is composed largely of dark grey, argillaceous dolomites with occasional limey beds and sandy beds. It is thin-bedded and assumes a shaly habit and a reddish brown colour on weathering. Fossils are scarce, fish fragments being the only specimens collected. A Lower Triassic age for the formation has been proved in the Banff area.

In the Crowsnest section, the Spray River is about 350 feet thick and about the same thickness is exposed on Erickson ridge. It lies with apparent conformity on the Rocky Mountain quartzite. An unconformity between the Spray River and the Rocky Mountain quartzite was proved in the Banff area. The formation is overlain by the Fernie shale, the lowest bed of which is a phosphate bed. The formation thickens to the west as, according to information from Mr. Telfer, it attains a thickness of 1,700 feet in the Lizard range west of Elk river.

On the east side of Livingstone range some beds are exposed which the writer believes to be the Spray River formation. They consist of about 50 feet of light grey, sandy dolomite weathering to a buff colour and assuming a shaly habit. These beds lie on the Rocky Mountain quartzite, being separated by about two feet of chert conglomerate. They are overlain by the Fernie shale, the lowest bed of which is a phosphate bed. McLearn²³ and MacKay²⁴ included these beds in the Fernie shale. Though these beds are not altogether characteristic of the Spray River, they are the same type of rock, assume the same habit in weathering and are in the same stratigraphical position as that formation. It is assumed by the writer that these beds represent the Spray River formation, the slight change in lithological character being due to a difference in environment during deposition. The beds in question were not observed behind Turtle or Bluff mountain, though the chert conglomerate is exposed.

The scale of the accompanying section is too small to show these beds.

²³McLearn, F. H., Jurassic and Cretaceous, Crowsnest pass, Alberta: Geol. Surv., Can., Sum. Rept. 1915, pp. 110-112.

²⁴MacKay, B. R., The Mesozoic-Palaeozoic contact and associated sediments, Crowsnest district, Alberta and British Columbia: Geol. Surv., Can., Sum. Rept. 1931, pt. B, pp. 19-20.

Jurassic

Fernie shale. The Fernie shale was originally included in the Cretaceous and was separated later when Jurassic fossils were found in the formation. The inclusion of the Fernie in the overlying Kootenay was a very natural proceeding as the contact between the two formations is gradational.

The Fernie was first studied in Elk River valley near Fernie, where the formation is not completely exposed. Exposures of the whole formation are rare as the shales weather easily and are generally covered, in part at least, by debris. The thickness of the formation can generally be obtained, however, even though a good portion of the beds is not exposed. The overlying Kootenay sandstone usually forms a significant topographic feature and the underlying Spray River formation and Rocky Mountain quartzite are usually well exposed.

MacKay²⁵ estimates a thickness of 900 feet for the Fernie in the Bluff mountain succession. This includes the 50 feet of sandy dolomite considered Triassic by the writer, and the passage beds at the top which may not all be included in the Fernie in some of the sections measured. In the Crowsnest section the thickness of the Fernie is 808 feet according to measurements by Messrs. Telfer and White and the writer. Another good measurement was made in the mountains south-west of Corbin, where a thickness of 800 feet was obtained. These measurements check quite closely. MacKay, however, gives a measurement of 2,800 feet for the formation at Corbin.²⁶ It is possible that the section here is duplicated by faulting. It is very unlikely that a complete section could be measured in the type area at Fernie as the beds are badly broken up. It is reasonable, therefore, to consider a thickness of about 800 feet as a fairly exact measurement of the formation in this section though it is probable that the formation thickens a little to the west and this thickening was allowed for in drawing up the cross-section.

In all the sections of Fernie shale studied by the writer, the lithological development was remarkably constant. The basal bed is always a phosphate bed with a thin marcasite horizon at the bottom. This is followed by black shale from 50 to 200 feet thick. Overlying this shale is a calcareous sandstone bed of varying thickness but usually less than 20 feet. It often contains belemnites and the term "belemnite bed" has been applied to this member by Mr. Telfer. The remainder of the formation is dark grey to black shale which grades upwards by the

²⁵MacKay, B. R., loc. cit., p. 19.

²⁶MacKay, B. R., Corbin coal field, B.C.: Geol. Surv., Can., Sum. Rept. 1930, pt. A, p. 158.

introduction of sandy beds into the heavy sandstones of the Kootenay. In most sections there is a development of from 200 to 400 feet of light grey, calcareous shale with small, hard, calcareous nodules which usually commences about 300 feet above the "belemnite bed". This calcareous shale member is not well developed in the Blairmore area though it was observed in the partial section of the Fernie on Rock creek on the east side of Livingstone range.

The following section of the Fernie was measured in the Crowsnest succession:—

Overlying formation the Kootenay sandstones.

75 feet. Black sandy shale.

375 feet. Grey, calcareous shale.

277 feet. Black, sandy shale.

12 feet. Calcareous sandstone with belemnites.

164 feet. Black shale.

5 feet. Phosphate bed.

808 feet. Total.

Underlying formation, the Spray River.

Fossils have been found at various horizons in the Fernie. The lowest horizon at which collections have been made is the phosphate bed which has been determined by the writer to be Lower Jurassic about *Microderoceratan* age.²⁷ The next fauna occurs in the "belemnite bed". In the Crowsnest region this bed is remarkably barren of fossils except for belemnites and some places even the belemnites fail. In the mountains to the north of Crowsnest pass this bed contains a considerable fauna of Bajocian or lower Middle Jurassic age.²⁸ This fauna was found at only one locality in Crowsnest pass, at the top of the "belemnite bed" on Rock creek. This find enables us to correlate the "belemnite bed" with the Bajocian horizon farther north. It also enables us to tie in McLearn's *Chlamys mcconnelli* fauna which he obtained on the south slope of Grassy mountain north of Blairmore.²⁹ The Lille member of McLearn, which contains the *Chlamys mcconnelli* fauna is undoubtedly at the top of the "belemnite bed" and the fauna must therefore be about Bajocian in age.

The third fauna occurs through quite a thickness of the shales above

²⁷Warren, P. S., A Lower Jurassic fauna from Fernie, B.C.: Roy. Soc. Can., Trans., Vol. 25, sec. 4, 1931.

²⁸Warren, P. S., A new pelecypod fauna from the Fernie formation, Alberta: Roy. Soc. Can., Trans., Vol. 26, sec. 4, 1932.

²⁹McLearn, F. H., Mesozoic palaeontology of Blairmore region, Alberta: Geol. Surv., Can., Bull. 58, pp. 84-87, 1929.

the "belemnite bed". McLearn calls it the *Corbula munda* fauna³⁰ and from the contained ammonites is definitely placed as about Callovian age. It is unnecessary to speak further of this fauna as it has been admirably described by McLearn³¹ and Buckman,³² except to mention the finding of some of the elements of the same fauna in a section of Fernie south-west of Corbin. There are many new elements in the Corbin fauna so it is probably of a little different age from the Callovian assemblages collected near Blairmore.

The fourth fauna which can be definitely dated is the *Cardioceras* fauna from Fernie.³³ No further evidence could be obtained regarding this fauna so it need not be mentioned further at this time.

Cretaceous

Cretaceous strata form a very important group of rocks in the section through Crowsnest pass. They include the coal-bearing Kootenay and the Blairmore sandstones which are for the most part Lower Cretaceous in age. The Upper Cretaceous is represented by the Crowsnest volcanics, the Alberta (Colorado) shale and the Allison formation. These rocks were not studied by the writer and, therefore, will not be discussed in this paper.

Summary of stratigraphic results. The principal stratigraphic results of this study are:—Firstly, the identification of a Naples fauna in the Minnewanka formation and the comparison of the Minnewanka with other sections in the Canadian Rockies; secondly, the correlation of the upper part of the Rundle limestone with the Brazer limestone of Idaho and further proof of the Mississippian age of the whole formation; thirdly, the extension of the Spray River formation to the front ranges and, fourthly, the dating of the *Chlamys mcconnelli* fauna of the Fernie shale on Grassy mountain as about Bajocian age.

³⁰McLearn, F. H., loc. cit.

³¹McLearn, F. H., New pelecypods from the Fernie formation of the Alberta Jurassic: Roy. Soc. Can., Trans., Vol. 18, sec. 4, 1924.

³²Buckman, S. S., Jurassic Ammonoidea in Mesozoic palaeontology of Blairmore region, Alberta: Geol. Surv., Can., Bull. 58, 1929.

³³Whiteaves, J. F.? Description of a new species of *Cardioceras* from the Crowsnest coal fields: Ottawa Naturalist, Vol. 17, p. 65, 1903.

A HISTORY AND LIST OF THE BIRDS OF MIDDLESEX COUNTY, ONTARIO, CANADA

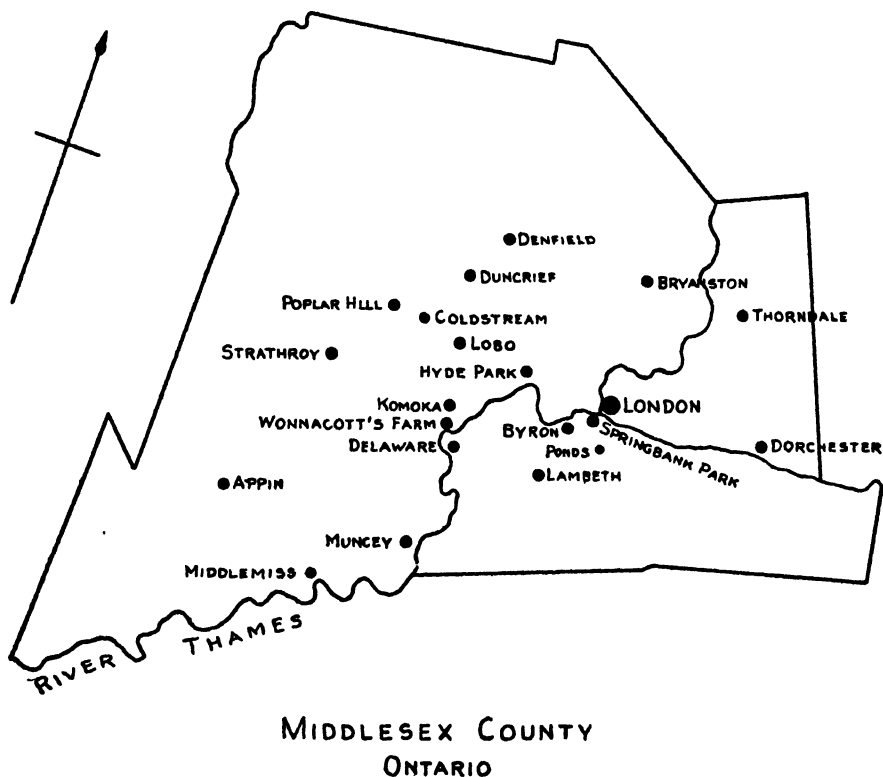
To December 31st, 1931

By W. E. SAUNDERS AND E. M. S. DALE

For some time it has been felt that a list of the birds of Middlesex County should be prepared and placed on record, and, although the task has been rather a long one it has been by no means unpleasant. It is hoped that the results now presented will be of interest to bird students. The earliest list containing any reference to the birds of this district is one published in *The Canadian Sportsman and Naturalist*, Montreal, in the issues of November and December, 1882. This was entitled "List of the Birds of Western Ontario" and was compiled by John A. Morden and W. E. Saunders. It contains some very interesting records many of which have been incorporated in the following notes. The next was "An Annotated List of the Birds of Coldstream, Ontario, Vicinity", by A. A. Wood, published in 1920 and 1921 in the *Canadian Field-Naturalist*, Vol. 34, pages 47-53 and Vol. 35, page 100. The first list contained references to many localities outside the county, while the second dealt with only a portion of the district, so that the present effort is really the first attempt that has been made to collect and publish data regarding all species of birds which have at one time or another been found here.

Middlesex County reaches west to within about seventy-five miles of the south-western corner of the Province of Ontario, and this being so, it is not strange that many southern species occur within its limits. It is rather irregular in outline, measuring some forty-five miles from east to west and thirty miles from north to south. London, which is the principal place, is situated in Lat. 43° N., Long. 81° 15' W., and is some 805 feet above sea level. The land is gently rolling, the highest point in the county being probably 1100 feet, and the lowest about 650 feet, above sea level. The country is well settled and the land in general under cultivation. There are now no stretches of heavy woods, neither are there any extensive swamps, bogs or marshes. A number of small streams and rivers are to be found throughout the district, the largest being the Thames, whose north and south branches meet at London and proceed westward on their way to Lake St. Clair. Although not far from Lake Erie, which is some ten miles south of the southern border

of the county, it does not touch that body of water, a fact which doubtless deprives us of many records. To illustrate, there are, within the boundaries of Middlesex (apart from the streams mentioned above) only a few small ponds to attract water birds, and no beaches or mud flats at all on which to look for waders. Notwithstanding this handicap,



diligent work extending over many years has resulted in a goodly number of species of water birds being recorded, most of the recent additions to the list being birds of this class.

Middlesex County enjoys the distinction of holding the only Canadian record of the Worm-eating Warbler; the first Canadian records for the Hooded Warbler and Bewick's Wren; two of the three Kentucky Warblers taken in Canada [the one reported by Dionne as taken by a "Mr. Nelson"¹ at Quebec (Macoun, *Catalogue of Canadian Birds*, 1909) probably antedating Robert Elliott's Middlesex specimen although no date is given]; as well as the first Ontario record of the Clay-coloured Sparrow.

¹Should be Neilson.

Of ornithologists, the earliest of whom anything is known is George Holman, of London, whose activities closed probably about 1870. He collected quite a few specimens, but they are, unfortunately, without much data, and his notes do not add much to our present knowledge of the birds of the district. His collection, which contained the Cape May Warbler (then a very rare bird), Yellow-breasted Chat and Richardson's Owl, is in the National Museum of Canada at Ottawa. Another early naturalist was George Shaver who lived at Pond Mills. His collection contains some fairly rare specimens including Eastern Evening Grosbeak, Common Tern, Passenger Pigeon and Bonaparte's Gull. Of those of more recent date, the senior author, with London as the centre of his activity, has been studying birds for well nigh sixty years, a much longer period of time, of course, than any of the others, the result of whose work will appear in the following notes. These include Robert Elliott, of Bryanston, who died on December 19th, 1902; John A. Morden who was active in the vicinity of Hyde Park in the 70's and 80's; Roger T. Hedley of Duncrief to whom birds give an added interest to life on a farm; A. A. Wood who has made a number of notable records in the vicinity of Coldstream and Strathroy; C. G. Watson and other members of the McIlwraith Ornithological Club of London, who are active in the field during the migration season, recording arrivals and looking for rarities (which come along every once in a while to stimulate the interest).

The "Ponds", which may be frequently mentioned in these notes, are a group of three small bodies of water about a mile south of London and are a favourite hunting ground for bird students from the city. They have given us many interesting records but no doubt there are other favourable spots in the county that we never visit, but which, if searched as diligently, would perhaps give equally good results. For purposes of location we usually designate these ponds individually as "Saunders'," "Spettigue's" and the "South Pond".

The dates of arrival given have been derived from the records of the McIlwraith Ornithological Club covering the years 1910 to 1926 inclusive. This list was compiled a few years ago and published in the local press (1927) for the benefit of the students who now have a certain amount of nature study included in their curriculum. It has since been incorporated in the new textbook on Zoology for High Schools, by J. F. Calvert, M.A., and J. H. Cameron, authorized by the Minister of Education for Ontario, published in 1928.

The nesting dates are from the collections and records of W. E. Saunders, A. A. Wood and others. We also acknowledge much valuable information in this connection compiled by James L. Baillie, Jr., and supplied by him through the courtesy of the Royal Ontario Museum of

Zoology. No attempt has been made to give all the dates which were at hand for many of the species, four or five having been thought sufficient to give a general idea of the various times when nests and eggs have been found. Unfortunately some of the early record books of W. E. Saunders were not available, otherwise the list of species and dates might have been more complete. It would appear that there are still many birds, some of them quite common at that, whose nests and eggs have never been taken in the county, although this is, perhaps, not a matter of very great concern.

In the early days the land was, of course, heavily wooded, and pigeons, turkeys and other wild fowl abounded, as did also other large birds such as hawks and owls, which liked the heavy forests. Settlement and the consequent clearing of the land have changed conditions very materially, many birds having gone for ever while their places have been taken by others to whom the fields and fence corners offer attractive nesting sites which were not available hitherto. Even after the land generally was under cultivation there still remained areas which were veritable bird paradises. One such place, which was very accessible to London, was Komoka swamp where many northern species found congenial surroundings. This is, alas, no more the case, as the trees have been cut down, the swamp drained, burned and otherwise "improved" by the "grasping tentacles of civilization" until it is now scarcely worth visiting.

Our thanks are due to those who have helped make this paper possible by placing at our disposal their notes and other results of their study; also to Macoun's *Catalogue of Canadian Birds*, and McIlwraith's *Birds of Ontario*, which have been frequently consulted, as well as to the two former lists mentioned above which have simplified our work to a considerable extent.

It may be interesting to Middlesex readers to con a list of birds which have been found nearby and which may be found in this county at some time in the future: e.g., White-eyed Vireo (*Vireo griseus griseus*) of which there is one specimen from Woodstock, Ont., and two from Point Pelee; Tufted Titmouse (*Baeolophus bicolor*) which has been seen in Elgin County; Kirtland's Warbler (*Dendroica kirtlandi*) which has been taken at Toronto and Point Pelee; Blue-winged Warbler (*Vermivora pinus*) which has been taken at Point Pelee; and Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*), less probable, which has also been taken once at Point Pelee.

The A.O.U. Check-list (1931) has been followed as to order of species and also as to both common and scientific names. It is rather difficult to recognize some of our old friends by their new common names, and

while these will not be used generally amongst ourselves when speaking of the various species in which changes have occurred, it has been felt that in an article such as this, which will be printed and possibly circulated in parts of the country where Bluebird, Robin, Song Sparrow may mean an entirely different bird to ours, that the names, both vernacular as well as scientific, should be given exactly as they appear in the latest check-list, so there may be no doubt whatever as to the species under discussion.

(7) COMMON LOON. *Gavia immer immer*.—Arrives from the south about the middle of April and observed from then until well on to the end of May. Some mornings when migration is in full swing, eight or ten may be seen flying over the city usually in ones and twos and heading in a north-westerly direction. They are at times seen on the river but more frequently on the "Ponds" where their noble bearing and wild ringing calls never fail to give a thrill to the onlooker. On April 19th, 1923, there were ten birds on Saunders' Pond at one time—a splendid sight. In 1928 a pair was seen daily at the same place until the middle of June and it was thought they were nesting, although the nest was not found and finally the birds disappeared.

On July 6th, 1924, and again on July 4th, 1926, a Loon was seen to circle around Saunders' Pond but although we thought it was going to alight it flew away without doing so. On July 2nd, 1930, an immature bird was observed, on the River Thames near the traction bridge, it being the centre of interest to quite a group of men and boys. It would be interesting to know from where these midsummer birds come.

Average date of spring arrival (15 years) April 13th. Earliest April 3rd, 1921.

(11) RED-THROATED LOON. *Gavia stellata*.—Rare visitant inland though doubtless regular on the larger waters. The senior writer has seen but one, on May 5th, 1902, two miles west of London on the River Thames. It was swimming and diving one hundred yards away and satisfactorily identified with a glass.

The earliest available record is of an adult shot on the Thames near Byron in the spring of 1881. John A. Morden mounted it. Other records are:—one seen on the river near Hyde Park on February 21st, 1885; "C. Brick saw a large Loon with a rusty red throat, in the middle of the river near Bryanston, January, 1898" (*Diary of Robert Elliott*); and on November 11th, 1898, a young bird was caught in a strawberry bed between Byron and Delaware by A. Deadman and brought to the senior writer. It is now in his collection.

(2) HOLBOELL'S GREBE. *Colymbus grisegena holboelli*.—Of rather rare occurrence, usually not more than one being seen each season, and sometimes several years go by without even one being reported. There are, however, exceptions to this general rule. In 1925 we went out to the "Ponds" on the afternoon of April 19th, arriving in such a heavy down-pour of rain that we had to remain in the car for half an hour until it subsided enough for us to venture out. Our first glimpse of the water showed a lot of water fowl present, including a "flock" of three Holboell's Grebes, the first time on record when more than one of this species had been seen at one time. Again, in 1928, two were present at the "Ponds" on April 23rd but were gone the next day.

There are two winter records, the first a bird shot by Harry McCann on the river a few miles west of London (January 18th, 1910), which is now in the Saunders collection. The second one was found on an open stretch of the river just below Byron on February 16th, 1929. It remained there for several weeks, finally disappearing when the river broke up.

Average date of spring arrival (8 years) April 20th; earliest April 14th, 1925.

(3) HORNED GREBE. *Colymbus auritus*.—A fairly common migrant the spring birds arriving early in April and remaining about a month. Sometimes ten or a dozen may be seen in one morning on the "Ponds". They seem to prefer the "Ponds" to the river. One interesting record is that of a Horned Grebe in the grey plumage seen on the River Thames a couple of miles west of London on March 18th and again on March 25th, 1916. The weather had been very cold, 5 degrees below zero on the 16th, and the river was pretty well frozen up. Shortly afterwards the river broke up and the bird disappeared. On December 22nd, 1917, one in the summer plumage was seen on the river a few miles west of the city.

Something probably as important to place on record as the above occurrences, is the fact that despite all our hunting we did not see a single Horned Grebe during the spring of 1927. In the fall of that year two immatures were observed on October 9th, and an adult on one other occasion, these being the only records for the county during the whole year.

In marked contrast to that rather barren year we might cite the spring of 1929, in which year Horned Grebes were first noted on April 5th and from then on scarcely a trip was made that did not result in one or more of these birds being recorded. The big day, however, was May 1st when about 125 were counted on Saunders' and Spettigue's Ponds and at Pond Mills, the latter being two semi-detached ponds about a mile to the east of those first mentioned. Others were also seen at the Coves

the same day, and perhaps if further search had been made they might have been found in other places as well. There is no record of any previous concentration of one species of water fowl that begins to approach this in numbers. In addition to the grebes there were present many ducks and coots also.

On October 28th, 1908, a Horned Grebe was caught on Richmond St. near the corner of Dundas in the city of London and brought to W. E. Saunders who recommended that it be placed in the river.

An interesting record in connection with the Horned Grebe was made by William Girling and his brothers early in the morning of April 21st, 1929. As they were going south on Adelaide Street (London) they observed the Grebe ahead of them on the pavement. It pattered along as it would in the water and finally rose into the air and flew to the river, a distance of two or three blocks.

Average date of spring arrival (17 years), April 12th; earliest March 30th, 1921.

(6) PIED-BILLED GREBE. *Podilymbus podiceps podiceps*.—The Pied-billed Grebe is probably the commonest member of the family, arriving early in April usually slightly in advance of the preceding species, and staying until the first or second week in May. A. A. Wood, Coldstream, reports that a pair bred there quite regularly previous to 1904. In the spring of 1926 a pair attempted to nest on a little pool near London, but after building the nest the water receded to such an extent that they had to abandon the location. The pool finally dried up altogether as it usually does each summer.

We have one winter record for the species, a bird found on December 26th, 1931, by Will Girling, on the river Thames about two miles west of the city. It was seen several times later, during the winter, by other members of the Bird Club.

Average date of spring arrival (17 years), April 7th; earliest, March 25th, 1911.

Hypothetical. (125) WHITE PELICAN. *Pelecanus erythrorhynchos*.—"The London (Ontario) Advertiser says that Mr. George Jackson of that city, while on a shooting expedition recently, shot a splendid specimen of the Pelican, rare birds in this part of the country. Handed over to Mr. Mummery for mounting". "Rare Birds for Canada". *Forest and Stream*, 7: 212, November 9th, 1876.

It is not known where this specimen was taken but it is doubtful that it was in Middlesex County. The record is given here as above reported but the species has been put on the hypothetical list.

(194) GREAT BLUE HERON. *Ardea herodias herodias*.—These birds arrive on their nesting grounds very early. Just how early it would be difficult to say as there is no colony very close to London, and the records of "first arrivals" that we have made are, we know, far from being representative of the actual arrival date of the birds in the county at the places where the colonies are situated. Single nests have been noted from time to time although the species usually prefers to live in colonies, sometimes at a considerable distance from water.

There are a number of winter records, January 1st, 1913; January 1st, 1915; December 24th, 1921. These birds look very much out of place amidst ice and snow and, judging by the remains of one found hanging in a witch-hazel bush, on February 15th, 1913, it would appear that some of them at least come to a sad end.

Average date of spring arrival (10 years), March 29th; earliest, March 19th, 1910.

A set of four slightly incubated eggs was taken by A. A. Wood, in East Williams, on April 28th, 1914. Another set of six heavily incubated eggs was taken by Clifford Zavitz, near Coldstream, on May 10th, 1901.

(196) AMERICAN EGRET. *Casmerodius albus egretta*.—"On August 19th, 1882, a few miles below Middlemiss, on the River Thames, I shot a young bird of this species. It was feeding on the river bank. I made a rough skin of it and rowed it to Lake St. Clair before returning to London. The specimen was such a poor one that it was destroyed in two or three years." (Notes W. E. Saunders.)

It is quite possible that some of the following three records may refer to immature birds of the next species:—E. T. Caverhill, Spruce Grove Farm, Lobo Township, stated (1928) that he had seen three at different times about 35 years ago. One was shot, the specimen being preserved for some time but finally destroyed. Walter Douglas, Ilderton, also reported having seen an Egret at about the same time as Caverhill's. Isaac Hodgson, R.R. 3, Denfield, stated (1928) that he had seen a "White Heron" about twenty-five years ago.

A more recent record for the Egret, however, was made on September 27th, 1930. Having heard that a large white bird had been seen at the "Ponds", we went out on the morning mentioned and found, as we had rather suspected, an American Egret. The morning was quite frosty and the bird was standing on the south shore all huddled up with the cold. We made rather a wide detour as we went in but on the return were more careless and the bird took alarm, assuming a very much more life-like attitude and finally flying across the water where it again came to rest near the "point". The size, together with the heavy, yellow bill and black legs, rendered identification easy and certain. The bird

remained for most of the day and was seen by quite a number of the members of the Bird Club.

(200) LITTLE BLUE HERON. *Florida caerulea caerulea*.—It is always interesting to add a bird to one's life list, but when this bird is also a new record for the county, the pleasure is greatly increased.

On August 2nd, 1930, Mr. and Mrs. Eli Davis called for the junior writer and his wife, to go to the country for a picnic supper and escape the city heat. When crossing Komoka bridge we stopped to scan the river, and seeing a flock of birds half a mile up-stream that looked like waders, we drove back to hunt them up. All thought of the waders was lost, however, when Mrs. Dale espied a white heron standing in the water. It flew up-stream, turned and flew down-stream, finally alighting in a tree on the north side. We waded across but although the bird was too wary to allow as close an approach as we would have desired, we were able to make out quite easily the fact that it had yellowish-green legs, the field mark of the juvenile Little Blue Heron. It was seen again the following day, practically all of the field men of the Bird Club journeying out to make its acquaintance. On August 9th three were seen together on the River Thames below Byron, but on August 16th, when we patrolled the river from Byron to Delaware to find out how many there actually were, we did not succeed in finding any at all, much to our disappointment.

While white herons usually wander north each summer, the movement was much greater during the summer of 1930, reaching even into Ontario. Immature Little Blue Herons were noted at London and Port Bruce; American Egrets at London and West Lorne, while "White Herons" which may, of course, have been either of the above species, were seen at Brussels, Galt and Niagara.

(201) EASTERN GREEN HERON. *Butorides virescens virescens*.—A fairly common summer resident throughout the district. They stay until quite late in the fall at which season of the year we find them in the muddy shallows of the river along with the sandpipers.

Average date of spring arrival (17 years) April 28th; earliest, April 20th, 1917.

Nesting dates: Set of five, May 29th, 1902, incubated one-half; set of five, May 23rd, 1904, incubated one-quarter; set of five, May 23rd, 1905, fresh; set of four, June 10th, 1907, heavily incubated; set of five, June 13th, 1917.

(202) BLACK-CROWNED NIGHT HERON. *Nycticorax nycticorax hoactli*.—This species is usually regarded as accidental in Middlesex; at least

we have no record of its nesting, although in August, 1918, a young bird was seen several times at the "Ponds" by W. E. Saunders and others, while in August, 1930, two adults and two, if not three, young were seen many times along the river a mile east of Byron. In June, 1923, one was reported from the "Ponds", remaining there for several weeks, and in 1924 an adult was seen on May 21st and on several subsequent days.

On August 24th, 1892, W. A. Balkwill shot one near St. Johns. There was also a juvenile Night Heron shot near St. Johns in the fall of 1893, which was taken to Wm. Gurd & Co. to be mounted. We do not know where either of these specimens are now.

(190) AMERICAN BITTERN. *Botaurus lentiginosus*.—A common summer resident in all suitable localities. Their average date of spring arrival (17 years) is April 15th, earliest March 28th, 1925, and from then on their well-known pumping is a characteristic sound from marsh and bog.

On June 4th, 1916, A. A. Wood took a set of four at Coldstream, while on May 20th, 1928, a nest with five eggs was found in a cat-tail swamp between Komoka and Delaware, the set not being taken.

(191) EASTERN LEAST BITTERN. *Ixobrychus exilis exilis*.—In the fall of 1889, J. W. G. Winnett shot a Least Bittern on a marsh on his farm at the north end of Maitland St., London, the first record for the county.

Harry Gould reported, on June 9th, 1892, that a Least Bittern had been shot on the 4th at the "Old Channel", three miles north-east of London, and on June 11th the deserted nest was found. On June 3rd, 1895, three Least Bitterns were reported as having been shot at the "Old Channel" a few days previously. They have been also found in this locality during recent years.

Just when they began living at the "Ponds", however, we do not know. The first record for that spot was made by J. C. Higgins on May 24th, 1915. The next record was May 30th, 1917, only one bird being seen each time, which led us to believe that they were accidental visitors. The following year, however, a family party of six were found by W. E. Saunders, on August 2nd, which definitely established the fact that they had nested there. We missed them in 1919, but from 1920 on, they have been found each year. The "colony" does not seem to consist of more than one or two pairs. They are very secretive birds and it was only after we learned their notes that we succeeded in listing them regularly. It is quite possible they have been living at the "Ponds" for many years and have been overlooked, the strange notes of marsh birds being sometimes difficult to trace to their source.

There is apparently only one local specimen to be found now, a bird shot by A. A. Wood, Coldstream, on September 13th, 1917, which is now in the collection of J. H. Fleming, Toronto.

A nest was found at the "Ponds", on June 20th, 1920, containing six eggs. The set was not taken.

Average date of spring arrival (7 years), May 18th; earliest, May 2nd, 1923.

(180) WHISTLING SWAN. *Cygnus columbianus*.—Three were seen on the Duncrief mill pond by A. L. Charlton one spring about ten or twelve years ago. One was shot three miles from Duncrief some four or five years ago, the specimen being mounted.

The first big flight, however, was on the night of November 2nd-3rd, 1924, when London was visited by a flight of waterfowl which included many Swans in its numbers. The birds were first heard flying over the city about 11 p.m. and from then until about 6 the next morning, the flock, or flocks, puzzled no doubt by the lights of the city, apparently kept flying to and fro until approaching daylight enabled them to get themselves "located" and continue their journey. They were heard by a great many people in various parts of the city, some having been awakened by the noise. W. E. Saunders first suspected their being Swans by their notes, and he spent from midnight until about 2.30 a.m. in and near Victoria park observing them. Often the birds flew so close to the ground that they could be counted through the glass, and on one occasion there were three flocks of forty, thirty and twenty. They flew at various altitudes, sometimes so close that they could be seen with the naked eye, and at other times so high that they could not be picked up even with a glass. About 2.30 a.m. they had formed into a beautiful crescent consisting of about thirty or forty birds, and behind the belly of the crescent there were ten or fifteen scattered birds. The flock was going east and was the most beautiful sight of the night. They swung south and returned passing overhead a second time heading north-west. Reports of similar flights the same night were received from correspondents in Kitchener, Listowel, Owen Sound, Cargill, Stratford. (See *The Canadian Field-Naturalist*, 40: 90, April, 1926, "Birds Drowned in Lake Huron", by W. E. Saunders.)

John A. Morden reported three flying over the "Ponds" on March 24th, 1927. In 1928 there was a flight near London on March 25th and 26th, a number of flocks being reported at various times by several observers. One seen by Eli Davis and E. M. S. Dale numbered 42 individuals and was flying west in a "V" formation, at Kilworth. On March 27th, 1929, five were found on Saunders' Pond by Mrs. E. H. McKone who watched them for half an hour before they took flight.

In 1929 they were noted also on the southward flight, a flock having been heard flying over in the night of November 9th. In 1930 they were both seen and heard on some half dozen occasions between April 2nd and 6th the numbers varying from a single bird which stayed on Saunders' Pond for two days, to a flock of some 150 birds noted near Byron.

It would surely appear from the above that the Whistling Swan is increasing in numbers, as of recent years they have been observed many times in both spring and fall, while previously they were rarely noted. Let us hope that this may be true and that their numbers may continue to grow.

(172) COMMON CANADA GOOSE. *Branta canadensis canadensis*.—Geese pass through the district in goodly numbers in both spring and fall although not often seen in the immediate vicinity of London. They are, of course, usually in flocks, although on April 18th, 1924, one lone individual flew honking over the "Ponds" heading north-east. On April 30th, 1928, another solitary bird was seen at the same place while on May 2nd, 1929, history once more repeated itself, the bird flying round and round, head and neck outstretched, as if looking for something.

An interesting winter record is that of a single bird noted on one of the collecting ponds in Springbank park, London, on January 18th, 1930. It was so tame that it surely must have been a stray from Jack Miner's flock at Kingsville, or one of Thomas N. Jones' birds from Union.

Average date of spring arrival (11 years), March 21st; earliest March 3rd, 1919.

(169) LESSER SNOW GOOSE. *Chen hyperborea hyperborea*.—There are only two records for the county. One was taken by J. Wallis near Hyde Park, on May 1st, 1887, and is now in the Saunders collection. Another was shot by J. Waters, a farmer near Hyde Park on November 1st or 2nd, 1887, out of a pair in a field. The whereabouts of this specimen is not now known.

(169.1) BLUE GOOSE. *Chen caerulescens*.—A. Ralph, of the 6th Concession, London Township, shot a Blue Goose on the River Thames, between the 4th and 5th concessions, four miles north-east of London on November 15th, 1888. One foot was missing and the tissues were completely healed over. It was stuffed by Harry Gould, and is also referred to in the diary of Robert Elliott. We do not know where this specimen now is. (See addenda.)

(132) COMMON MALLARD. *Anas platyrhynchos platyrhynchos*.—This is more of a pond than river duck with us, seeming to prefer the

marshy, weedy shores of the ponds where it can find suitable food. It is rather irregular, in some years not being reported at all. It can scarcely be called common, in fact, it might be termed rather rare. It is seldom seen to advantage, usually breaking water and flying rapidly away before its presence is even suspected. A record of unusual interest, however, was the finding of a flock of ten (many of them males) at Wonnacott's farm, near Delaware, on December 22nd, 1928. From that date on through the winter and early spring Mallards were recorded quite a number of times, possibly members of the same flock. The following winter a female was noted on January 5th, 1930, again at Wonnacott's, in a flock of some 25 Black Ducks.

Average date of spring arrival (8 years), March 31st; earliest, March 14th, 1914.

(133a) RED-LEGGED BLACK DUCK. *Anas rubripes rubripes*.—Since Brewster described this in the *Auk*, 19: 184, April, 1902, its validity has been many times questioned. It is not our purpose to enter into the discussion further than to say that it has been recorded from Middlesex County on several occasions. A. A. Wood took a female at Duncrief on December 15th, 1922, while on May 8th, 1927, one was flushed at very close range and the bright red colour of its legs plainly seen. Others have been seen and also taken, but it is not possible to obtain any very definite information as to how rare or common it is, or how it compares in abundance with *tristis*. However, should it become definitely recognized, the instances above recorded will be sufficient to give it a place in the list of Middlesex birds.

(133) COMMON BLACK DUCK. *Anas rubripes tristis*.—Arrives about the end of March and is more regular, also much commoner, than the Common Mallard.

A. A. Wood reports that a flock of nearly 200 stayed in a slough about two miles south of Coldstream for two weeks in August, 1917. He states that they very seldom come to the ponds, seeming to prefer the little sloughs back in the fields, especially late in the season.

There are several winter records, one of a single bird flushed from one of the collecting ponds in Springbank Park (four miles west of London) on January 3rd, 1920. It was seen at intervals until February 28th, sometimes on one of these ponds or sometimes on the river in company with Golden-eyes and Mergansers. It flew strongly and was apparently uninjured. On January 4th, 1925, there were two Black Ducks along with twelve American Golden-eyes in the open water just below Byron bridge, doubtless attracted to the spot by some tame Mallards belonging to a nearby farmer. The man stated that one of

them was wounded in the leg as it limped when walking, but the one that we flushed seemed to fly laboriously and flopped almost immediately into the water again as if it might have been injured in the wing.

These records were, however, entirely eclipsed by the numbers seen during the winter of 1928-1929. Beginning with two flocks, 12 and 3 respectively, found on the Christmas Census (December 22nd, 1928), Black Ducks were recorded in flocks of varying sizes, and in many places along the river throughout the winter and early spring before the migrating birds arrived. During the winter of 1929-1930 they were seen again commonly, the largest number being 29 on January 1st. It would appear as if Black Ducks might be in future counted upon as one of the regular winter ducks.

It probably nests more often than we think, although we only have two definite records. About May 20th, 1914, a flock of eleven was found crossing the road east of Springbank Park (about four miles west of London) on its way from the nesting site to the river. A. A. Wood reports that in the spring of 1925 a clutch of eggs hatched near the creek at Poplar Hill. Five young from this nest found their way to the Coldstream Pond where they remained until nearly fully grown. These birds remained all winter on the creek near Poplar Hill and were regularly fed with corn.

Average date of spring arrival (17 years), March 28th; earliest, March 11th, 1922.

(135) GADWALL. *Chaulelasmus streperus*.—There are only a few occurrences on record, as follows:—

"May 6th, 1924; saw a couple of light grey ducks at the 'Ponds' this morning but could not make much out of them on the way in. Coming back one was at the east end in shallow water and allowed us to approach very closely. The light was excellent and the bird so tame that it swam towards us instead of away from us. The head was buffy colour, sides well speckled with darker brown, bill yellowish, mottled with black, and a white spot on the wings or side near the tail. We also made it fly to see the wing pattern. Reference to plates, descriptions and specimens seemed to leave no doubt that it was a female Gadwall, so far as we know the only record for the county". (Notes E. M. S. Dale).

On March 31st, 1925, a female was seen at the "Ponds" standing at the edge of the water, studied at close range with glasses.

On April 24th, 1926, a female was noted at the "Ponds", and on March 29th, 1927, a pair at the same place.

In 1929 this species was observed twice, first on April 4th and again on April 7th, both at the "Ponds".

In 1930 we made our first autumn record for the species, a single

bird which flew in and alighted on Saunders' Pond on the morning of September 27th, quickly disappearing amongst the reeds and rushes near the point.

In 1931 the species was observed several times. First, a flock of five at the "Ponds" on the morning of April 9th, while on April 11th there were three and on April 12th one at the same place.

(137) BALDPATE. *Mareca americana*.—There is a specimen, male, in the Saunders collection, taken at Redmond's Pond about 1880. This remained the only record for the county for about forty years, and is still the only specimen, but since 1921 they have been fairly regular and some years almost common.

Some of these recent sight records are:—April 6th, 1921, a pair, the male showing the white crown and other distinctive markings; April 13th, 1923, a pair at the east end of Saunders' Pond. All the markings were clearly seen as the birds were very, very tame. They finally climbed out on the ice, the pond being still frozen almost solid. October 5th, 1924, a female at the "Ponds" identified by W. E. Saunders; March 28th, 1925, and April 1st a pair; April 3rd and 4th a male, all at the "Ponds". The year 1926 was quite a good Widgeon year. On April 2nd two males and one female were observed on the Thames about a mile and a half west of London, the first record for the river. Later in the month, April 20th, a male was seen at the "Ponds" remaining there until May 1st. On April 30th there were two males and one female there. A pair was noted also on April 3rd, 1927, the only ones recorded that year. The year 1928 was rather a lean year for ducks and the Widgeon was missed entirely. This was amply atoned for in 1929, however, when eight males were seen on Spettigue's Pond on March 25th, the largest flock yet recorded. Noted twice in 1930, first, four males at Wonnacott's farm on April 5th, then half a dozen at the "Ponds" the next day. In 1931 this species was observed first on March 26th. Thereafter it was seen on both the river and the "Ponds" on many different occasions until April 18th. The largest number seen at one time was fifteen on April 5th.

(143) AMERICAN PINTAIL. *Dafila acuta tzitzihua*.—On May 12th, 1916, a male Pintail on the South Pond, was seen in splendid light and satisfactorily identified with the glass by C. G. Watson and E. M. S. Dale. This is the first record for the county.

On April 26th, 1922, a female Pintail at the "Ponds" was seen at intervals until May 9th. It was found always in the same corner and was identified by the size, colour, shape, and particularly by the whitish border to the speculum shown when the bird flew. This is well illustrated in Eaton's *Birds of New York*, plate 15.

On March 27th, 1925, at least six species were represented in the small flock of ducks at the "Ponds" among them being two male Pintails and one female.

On April 6th, 1927, eight Pintails visited Saunders' Pond, but after circling around for about five minutes trying to make up their minds that it was safe to alight, they evidently concluded otherwise and struck off to the north.

On April 13th, 1930, one was noted with some American Mergansers and American Golden-eyes on the river near Komoka bridge.

In 1931 the species was reported twice. On April 5th, three were found by Mrs. McKone on the river near Komoka, while on April 10th, the same observer saw no less than fourteen at the "Ponds" in the afternoon, constituting the largest flock reported to date.

(139) GREEN-WINGED TEAL. *Nettion carolinense*.—Not as common as the succeeding species, in fact of recent years it might be termed one of the rarer ducks, or at any rate one not often reported. There are specimens in the Saunders collection taken at the "Ponds".

Average date of spring arrival (4 years) April 5th; earliest, March 31st, 1925.

(140) BLUE-WINGED TEAL. *Querquedula discors*.—The common teal, usually seen in fair numbers each year.

In 1926 a pair nested three hundred yards west of Saunders' Pond, the nest being broken by a mower. It contained about eight eggs. The birds were not known to nest a second time. The female had lost a foot in a muskrat trap earlier in the season this accident probably inducing the pair to take up "housekeeping" at London. All might have been well had they remained on the Saunders property, but they went across the road to an alfalfa field where they got into trouble as above noted.

Average date of spring arrival (10 years) April 16th; earliest, March 26th, 1925.

(142) SHOVELLER. *Spatula clypeata*.—One of the rarest of Middlesex ducks, the few occurrences on record being as follows:—

One was shot on the Duncrief mill pond by Roger T. Hedley in October, 1916. Being badly mutilated by shooting at close range, the specimen was not saved.

There are also several sight records:—"April 18th, 1923: Went out to the 'Ponds' this evening with Mr. and Mrs. J. C. Middleton and C. G. Watson. Made the rounds as usual and at one time had seven Loons in the field of the glass at once. On the South Pond we found a pair of ducks, the female being pretty much plain brown, but the

male showed a lot of chestnut on the sides, white breast, patch of white near the tail, and the head and bill with a peculiar flattened appearance. We concluded they were Shovellers and reference to books and plates on our return home confirmed the identification." (Notes E. M. S. Dale.)

On April 14th, 1925, one was seen also at the "Ponds" by C. G. Watson.

On April 10th, 1931, we were fortunate enough to find two pairs of Shovellers on Saunders' Pond. They were close to the north shore and did not see us as we approached so that we were able to get very close to them and obtain an excellent view of the four as they slowly swam out into the open water.

(144) WOOD DUCK. *Aix sponsa*.—In the later years of the last century this bird was common on the rivers and doubtless bred on the smaller streams, but in the last ten years of the century it became so rare as hardly ever to be seen. Since 1920 it has been fairly regular on the "Ponds" in autumn, as many as twenty having been noted at one time. Their visit usually extends over several weeks beginning in August or early September. During the last few years they have usually been seen in the spring also. A pair spent a few days at the "Ponds" in the spring of 1925 being first reported on April 17th. In 1926 a male was observed at the "Ponds" on April 17th and again the following day. Also noted in 1928, 1929 and 1930. During the last named year one and sometimes a pair was seen on various occasions extending over several weeks and it was thought that they nested, a female being observed in July.

In the summer of 1898 Clifford Zavitz caught six, part of a brood, on Bear Creek, five miles north-east of Coldstream, which he raised until nearly fully grown when they escaped from the pen and were not seen again. This is the only known breeding record.

(146) REDHEAD. *Nyroca americana*.—There is only one specimen of which we are aware, a female taken by A. A. Wood, Coldstream, on October 15th, 1914. There are a number of sight records, however, the first being a male on a small collecting pond in Springbank Park, March 21st, 1914. It stayed there for a week and became quite tame, allowing us to approach within twenty or thirty feet. None was noted again until 1917 when two or three came to the "Ponds" with a flock of Blue-bills. There was then another skip of a few years, but since 1922 they have become more regular in their visits, one or more usually being seen each year. It is still, however, to be considered one of the rarer ducks with us.

Average date of spring arrival (8 years) April 10th; earliest, March 21st, 1914.

(150) RING-NECKED DUCK. *Nyroca collaris*.—In a general way this species closely resembles the Scaup and is probably often mistaken for it. On April 14th, 1920, a male was on a small pool near the Coves, just west of London and proved to be so very tame that we had an excellent opportunity to examine it at our leisure and thoroughly familiarize ourselves with its distinctive markings. The least conspicuous of these is the chestnut collar from which it gets its name, but the shape of the head, the white patch near the shoulder, and the white spot on the bill show up well even at some distance and make separation from the Scaup comparatively easy. Whether this species is increasing or not the fact remains that it is reported more frequently and in greater numbers each year. For some reason they seem to prefer Spettigue's Pond, possibly because it is shallower, although nearly all the other ducks seem to prefer Saunders' Pond. In 1930 it was one of the commonest ducks observed, the flock at the "Ponds" numbering 28 on April 10th. They were present there in varying numbers from April 5th to May 6th.

In December, 1931, we made our first winter record for this species. During the greater part of the month Will Girling had a Ring-neck under observation on the river, near the Watson Street dump, but although it stayed around until the date of our Christmas Census, and was duly recorded therein, it disappeared shortly afterwards.

A female was taken at Coldstream by A. A. Wood on October 3rd, 1921. Two males were found dead by the edge of Saunders' Pond on March 26th, 1929, evidently having drifted ashore after being shot. The specimens were duly preserved.

Average date of spring arrival (8 years) April 10th; earliest, March 27th, 1925.

(147) CANVAS-BACK. *Nyroca valisineria*. It is remarkable that a duck that had not been reported from the county before should be seen in 1924 on so many occasions. The first one was on April 13th, a male at the "Ponds" in company with 25 or 30 other ducks of various species. It flew away as we were watching it but later in the day one male and two females were seen there, as well as others at Pond Mills, about a mile away. On April 25th there was a female at the "Ponds" while from May 15th to May 25th a female remained in the same place becoming quite tame as it became used to seeing us about. On one occasion it swam into a clump of grasses not more than a foot or two in diameter and became so effectively hidden that we could not discover it with our glasses from the edge of the pond only 20 or 25 yards away. A male

was also seen at the "Ponds" in the fall, the date being November 2nd.

A female was seen at the "Ponds" in company with some Bluebills on April 15th, 1925.

In 1926 a female spent from April 20th to May 1st at the "Ponds", and in 1927 one was seen there on April 18th—a female on this occasion also.

In 1929 a pair was noted at the "Ponds" on May 1st, and the next morning a female was at the same place. On May 18th there were three males and two females present, the largest number yet recorded. In the bright sunlight they presented a splendid sight.

In 1931 a male was noted at the "Ponds" on April 10th, a day when ducks were particularly active and when many interesting records were obtained.

(148) GREATER SCAUP DUCK. *Nyroca marila*.—One was taken in 1901 by Roger T. Hedley at the Duncrief mill pond. The bird measured: length $18\frac{1}{2}$ inches; wing 9; bill $2\frac{7}{8}$. This remained the only record until 1924 when a pair was seen on May 15th at Spettigue's Pond in company with others belonging to the next species. In fact if the two had not been side by side we would not have presumed to make the identification.

On May 8th, 1926, there were two Greater Scaups, also on Spettigue's Pond. On this occasion in addition to having some Lesser Scaups with which to compare them for size, we were able to approach very closely and in splendid light note with our glasses the different colouring on the heads of the two species.

(149) LESSER SCAUP DUCK. *Nyroca affinis*.—This is one of our most abundant ducks, the birds arriving in the spring in early April, and on several occasions individuals have remained until the end of May or even into June. At its maximum the flock at the "Ponds" numbers 30 to 35 individuals.

In the summer of 1900 Clifford Zavitz claims to have seen and chased a brood of young Scaups on the pond at Coldstream.

Average date of spring arrival (17 years) April 5th; earliest, March 16th, 1921.

(151) AMERICAN GOLDEN-EYE. *Glaucionetta clangula americana*.—This species is to be found almost every winter in open places along the river, and later on in small numbers on the ponds as well. Their numbers vary from year to year. In 1921, for instance, only one was reported, whilst during the winter of 1924-1925 a flock of forty or fifty stayed on the river about two miles west of London for several weeks.

A Correction. (152) BARROW'S GOLDEN-EYE. *Glaucionetta islandica*.—The specimen taken by A. A. Wood on October 17th, 1917, thought at first to be of the above species (and so reported in *The Canadian Field-Naturalist*, 34: 48, March, 1920, has since been determined as *Glaucionetta clangula americana*. This correction is therefore deemed advisable. The specimen is now in the Royal Ontario Museum of Zoology.

(153) BUFFLE-HEAD. *Charitonetta albeola*.—This handsome little duck is none too common. Usually not more than two or three are seen and then in a day or two they are gone. A delightful exception to this was April 28th, 1926, when we found thirteen Buffle-heads on Spettigue's Pond, and four on the South Pond, the largest number we had ever seen in one day, or for that matter several days or even several years. The gunners claim that the unsuspicious nature of this bird is responsible for the great diminution in its numbers.

We have three winter records—one an adult male observed in Springbank park in a flock of American Golden-eyes on February 9th, 1918, while an immature male was found in exactly the same place, also with some American Golden-eyes, five years later on February 10th, 1923. On February 16th, 1929, a male in full plumage was noted in the river a mile west of London busily diving for food.

♂ Average date of spring arrival (17 years) April 10th; earliest, March 22nd, 1926.

(154) OLD-SQUAW. *Clangula hyemalis*.—Although very common on the Great Lakes where thousands are occasionally drowned in the gill nets, they are comparatively rare and irregular inland. We have a number of records, however, in winter, February 13th, 1912, (1), February 16th, 1912, (2), January 15th, 1923, (1), all being birds seen on the river within the city limits, and later on during March and early April, of others seen both on the river and at the "Ponds", one flock numbering some 15 or 20 individuals. In 1929 three or four spent nearly all the month of February on the river in the vicinity of Blackfriars Bridge, London, eventually becoming quite tame as they got used to seeing people pass by on the breakwater.

There is a specimen in the Saunders collection taken at Bryanston on May 8th, 1884. Roger T. Hedley also took a male in full plumage at the Duncrief mill pond. He had it mounted and it is now in his possession.

(162) KING EIDER. *Somateria spectabilis*.—One was taken by Roger T. Hedley on November 24th, 1900, on the Duncrief mill pond (*Ottawa Naturalist*, 15: 197, December, 1901). This is the only Middlesex record. The bird is now in the Saunders collection.

(165) WHITE-WINGED SCOTER. *Melanitta deglandi*.—One was shot near London in November, 1891, by Dr. D. H. Arnott, which is now in the Saunders collection. A specimen was also taken by Roger T. Hedley, at Duncrief on Thanksgiving Day, 1915. This bird is in the collection of J. H. Fleming, Toronto.

Besides the specimens above referred to, there is a sight record of one observed at the "Ponds", first by W. E. Saunders on November 10th, 1923, and again by others on the following day. It was identified by the size, being noticeably larger than the Bluebill that was close alongside, and the colour, which was solid black except for the white wing patch.

In 1931 we made our first spring record for the species when two birds were found at the "Ponds" on the morning of May 7th, by C. G. Watson. The next day Mr. Watson found another Scoter at the same place.

(166) SURF SCOTER. *Melanitta perspicillata*.—The first record for the county was a bird shot on November 16th, 1891, on the mill pond at St. Johns. The writers do not know where this specimen is now. One was also shot (out of a flock of three) on the river two miles west of London on October 8th, 1901, by J. Munnoch, Jr. This specimen is now in the Saunders collection.

(163) AMERICAN SCOTER. *Oidemia americana*.—One was shot by W. A. Balkwill, at St. Johns on October 16th, 1891. Another was shot by W. E. Saunders on November 13th, 1901, on the River Thames about two miles west of London. Both specimens are in the Saunders collection.

(167) RUDDY DUCK. *Erismatura jamaicensis rubida*.—Small flocks numbering from two or three birds up to ten (the highest record), pass through during April and May. They are not very common and in some years we miss them altogether. They are to be found on the river and also at the "Ponds". One was observed on Saunders' Pond on July 8th, 1928, the only summer record. The white head patch was conspicuous but the bird was not in the red plumage.

Average date of spring arrival (11 years), April 20th; earliest, April 13th, 1918.

(131) HOODED MERGANSER. *Lophodytes cucullatus*.—A handsome little duck and a fairly regular, but none too common, spring migrant, the average date of arrival (16 years) being March 23rd; earliest March 13th, 1915. The birds are so frequently seen in pairs that it would appear as though they were already mated when they arrive. They may be found at the "Ponds" and also on the river. They like to hide in the willows along the edge of the river and are frequently flushed from such situations. They often remain until late in April or even the middle of May. Robert Elliott reports that a male flew out of the woods on June 28th, 1889, and alighted on Plover Pond, from which fact we would be led to believe that it occasionally breeds in the county although neither eggs, nest nor downy young have been found. On May 31st, 1930, a female was seen on the river near Delaware. This may have been a breeding bird or an unmated one that did not go north with the rest. While our attention was taken up with some waders for a moment or two it disappeared. An interesting sequel to this is the record of a young bird seen on the river between Kilworth and Komoka on August 15th, 1930.

(129) AMERICAN MERGANSER. *Mergus merganser americanus*.—Usually to be found each winter in open places along the River Thames, at times being very abundant, whilst in other years, for some reason they are very scarce. In January, 1912, for instance, a flock of about 50 spent some weeks just below the forks, together with a few American Golden-eyes. In the winter of 1924-1925, the position was reversed, Mergansers having been seen twice only whilst Golden-eyes were quite common, a flock of 40 or 50 remaining for several weeks on the river about two miles west of the city (London).

Later in the spring, when the ice leaves the "Ponds", a few are to be seen there also.

(130) RED-BREASTED MERGANSER. *Mergus serrator*.—Although this species is very common on the large lakes, it is decidedly rare inland.

The first record for the county was an adult male seen by J. F. Calvert and C. G. Watson on the river about two miles west of London, April 27th, 1912. The next year during which the species was observed was 1922, when one male and several that were probably females were seen at the "Ponds" on April 3rd. On April 8th two males were seen at Pond Mills with two others that were doubtless their mates. On March 28th, 1924, a day when ducks were migrating actively, a flock of three flew overhead, one being identified as a male Red-breasted Merganser, and a few days later W. E. Saunders observed one at his Pond. A flock consisting of six individuals, three of each sex, was next seen on the

Thames just above Komoka bridge on April 22nd, 1928. They were watched for some time in excellent light and at very close range. In 1929 they were recorded three times, twice on the river near Komoka bridge and once at the "Ponds". The largest flock to date was one seen on April 18th, 1930, on the river a mile or two below Komoka bridge. On this occasion two males and nine females were noted together with about 75 American Mergansers, a good view being obtained both with field glasses and telescope.

The increasing number of this species and also other ducks observed in recent years, may indicate a growing number of water fowl generally, or it may perhaps be accounted for by a larger and more efficient band of observers aided by motor cars and better roads.

Although there are no Middlesex specimens of this species, the above sight records should be sufficient to warrant putting it on our list as the male is readily identified by his flowing crest and other markings.

(325) TURKEY VULTURE. *Cathartes aura septentrionalis*.—Those that formerly lived near Coldstream have apparently left as they have not been seen there for several years. A pair nesting in a hollow log near Kerwood, was visited on May 24th, 1927, and no doubt there are others within the county as they are seen every year during the migration period in spring. They are much commoner to the west, in Lambton County, where W. E. Saunders once saw nineteen in a single field near Forest.

Average date of spring arrival (9 years), April 24th; earliest, April 8th, 1922.

W. R. Campbell took a set consisting of one egg near Coldstream, May 18th, 1919, the nest being in a hollow log about twelve feet from the opening, their usual nesting site here.

(327) SWALLOW-TAILED KITE. *Elanoides forficatus forficatus*.—The *List of Birds of Western Ontario* (Morden and Saunders), published in 1882, reports that some years ago a pair of these birds stayed all summer about eight miles north-west of London. They were reported by a Mr. Vernor (now dead) towards Melrose, as "a pair of hawks with forked tails".

(334) EASTERN GOSHAWK. *Astur atricapillus atricapillus*.—One in the Saunders collection was shot by a farmer near London on November 6th, 1896, while the hawk was standing on a newly-killed hen.

In December, 1898, the late Joe Beck saw one which a farmer had winged and had alive. Reported by Robert Elliott.

"March 18th, 1907, saw the first one I have been positive of for Middlesex County, just west of Peters' swamp. When first seen it was on the ground resting while Crows were mobbing it from a respectful height. In a few minutes it flew, pursued across the field by the Crows. The hawk alighted in the edge of the woods and was not seen again. A notable morning for I got my first Harris's Sparrow on the way home." (Notes W. E. Saunders.)

On February 10th, 1930, one was flushed by Eli Davis near Byron, from the body of a freshly-killed rabbit. A trap was set and the hawk caught the next day.

These are, of course, not the only records for the county. The Goshawk is, however, a rare bird, many of our field-men who have been active for over twenty years have still to see their first Middlesex bird of this species.

(332) SHARP-SHINNED HAWK. *Accipiter velox velox*.—Formerly fairly common, now very rare. An odd one or two usually seen each winter. The spring birds arrive early in April and a few remain to nest in favourable localities.

Nesting records: set of five, June 6th, 1888, nearly fresh; set of six, June 8th, 1900, incubated three-fourths; set of four, June 3rd, 1901, fresh; set of five, May 23rd, 1904, incubated very slightly; set of four, June 27th, 1905, incubated about two-thirds.

(333) COOPER'S HAWK. *Accipiter cooperi*.—Somewhat less rare than the Sharp-shin. Arrives about April 4th, a few remaining to breed. Occasionally seen in winter.

Nesting records: set of five, May 6th, 1901, fresh; set of four, May 10th, 1902, incubation just begun; set of three, May 11th, 1903, fresh; set of three, May 13th, 1904, fresh; set of two, June 11th, 1908, incubated five days.

(337) EASTERN RED-TAILED HAWK. *Buteo borealis borealis*.—Formerly common but now much rarer. More or less local in distribution. A few pairs stay over each winter in which case they usually nest earlier. A. A. Wood reports a nest with three eggs found on March 30th, 1914. This pair was usually resident and laid at least a week earlier than the average migrating bird. Twelve nests were noted near Coldstream in 1916.

Nesting records: set of three, May 1st, 1901, just begun incubating; set of three, May 6th, 1902, two unfertile, one nearly hatched; set of three, March 30th, 1903, fresh; set of four, April 8th, 1903, incubated one-quarter; set of two, April 15th, 1905, incubated three or four days.

(339) NORTHERN RED-SHOULDERED HAWK. *Buteo lineatus lineatus*.—Like the Red-tail, formerly much more common than they are now, also more or less local in distribution. Occasionally seen in winter, the majority, however, arriving about the middle of March.

On May 10th, 1901, A. A. Wood and C. H. Zavitz found a Great Blue Heron's nest containing three eggs and one Red-shouldered Hawk's egg, all equally incubated (far advanced). The hawk doubtless had only laid one egg by the time the colony of herons arrived, when it was driven out. This hawk has been known to lay in a squirrel's nest of leaves without adding any twigs or sticks.

Nesting records: set of three, May 6th, 1901, incubated one-quarter; set of four, April 24th, 1902, incubation begun; set of four, April 18th, 1903, incubated one-sixth; set of three, April 25th, 1904, fresh; set of five, April 21st, 1905, incubation just begun; set of five, April 26th, 1906, incubated one-third.

(343) BROAD-WINGED HAWK. *Buteo platypterus platypterus*.—A rather rare migrant species. In former years sometimes seen passing in large companies. On April 27th, 1903, W. E. Saunders saw about one hundred, seven miles west of London. Fifty-six were circling in one flock.

Average date of spring arrival (17 years), April 23rd; earliest, April 14th, 1918.

Occasionally seen in late May, probably nesting. A nest was found once in the Hamilton Road swamp, five miles east of London, by W. E. Saunders. The bird was both seen and heard. The nest contained no eggs and was apparently never used as on the next visit to the swamp the birds were nowhere to be found.

There is a single egg in the Saunders collection taken by Robert Elliott who writes of the nesting of this species in Joe Beck's woods, Bryanston, as follows: "April 15th, 1897, Broad-winged Hawk on same nest as last year. April 22nd, visited the nest again, one hawk flying off the nest when I came within 100 yards of the tree. The mate came and both circled around, hovering over the nest and alighting several times. Both seemed much concerned but, as the female last year remained on the nest until J. McVey was half way up the tree, with only one egg in the nest, it is not likely there are any eggs yet. May 24th, visited the Broad-winged Hawk and found two young about a week old in the nest. They are downy, light grey, head nearly pure white. J. McVey brought one young down. It eats readily, birds, etc."

(347a) AMERICAN ROUGH-LEGGED HAWK. *Buteo lagopus sancti-johannis*.—A few seen each year. They come south early in November

and although an occasional bird will stay all winter if it locates a good food supply, the bulk pass farther on, straggling back throughout February, March and sometimes well on into April. They were more abundant than usual during the winter of 1927-1928, Roger T. Hedley having seen six in one day near his home at Duncrief.

(349) GOLDEN EAGLE. *Aquila chrysaetos canadensis*.—One wounded and captured on December 1st, 1900, near Lambeth. After living in London in captivity for a few months it was secured by W. E. Saunders and is now in his collection. This is the only specimen and was the only record, also, until one was seen by Eli Davis near Byron on February 14th, 1929.

(352a) NORTHERN BALD EAGLE. *Haliaeetus leucocephalus alascanus*.—One or two seen nearly every year. On March 16th, 1930, three, all adults with white heads and tails, were observed at one time near the Komoka bridge, a splendid sight indeed of this large and now rare bird.

In the spring of 1919 a pair nested near Delaware on the estate of Senator E. S. Little. The nest was an immense structure of sticks, etc., in the top of a large button-wood tree situated on what was, during high water in spring at least, an island several acres in extent. This locality is one evidently much to the liking of eagles as they have been seen there more frequently, perhaps, than in any other place in the county. It is not thought that they nested there again although an individual was actually seen on the nest early one spring, harassed by crows perched in the tree above it. The nest and tree blew down, or at any rate disappeared, during the winter of 1928-1929.

(331) MARSH HAWK. *Circus hudsonius*.—Anyone who has in spring seen the Marsh Hawk performing his extraordinary aerial evolutions will readily understand how appropriate is the scientific name *Circus*.

Although occasionally seen during the winter months, on December 16th, 1916, for instance, the species is for the most part migratory. Probably the commonest hawk, or at least the one most frequently seen owing to its habit of flying low, quartering over the fields looking for mice.

They were especially abundant during the winter of 1931-1932. On December 12th, we saw five in one afternoon, while ones and twos were reported many times during the winter.

Average date of spring arrival (17 years) March 21st; earliest, February 26th, 1922.

Nesting records: set of five, June 2nd, 1902, fresh; set of six, May 24th, 1906; set of five, June 1st, 1914, incubated one-half; set of six, May 13th, 1916, incubation slight; set of seven, May 18th, 1929, eggs not taken.

(364) OSPREY. *Pandion haliaëtus carolinensis*.—Usually one or two seen each spring either at the "Ponds" or flying up and down the River Thames. Like all large birds they are a fine target for gunners which contributes toward keeping their numbers down.

Average date of spring arrival (12 years), April 20th; earliest, April 11th, 1917.

It is not likely that they nest here although they have been noted as late as May 29th (1921) at Kilworth. A resident there stated that this particular bird had been around for some time. A. A. Wood saw one coursing over the mill pond at Strathroy on June 2nd, 1930, this being the only date, however, that it was seen.

(353) WHITE GYRFALCON. *Falco rusticolus candicans*. (See addenda.)

(356a) DUCK HAWK. *Falco peregrinus anatum*.—A very rare migrant, not more than one being seen every four or five years.

The *List of Birds of Western Ontario* (Morden and Saunders), 1882, states that one was taken near London in 187=.

There is a specimen in the Saunders collection taken on April 14th, 1885, a few miles west of London.

One was seen near Komoka on April 5th, 1930. This is the latest record and in fact the only time this species has been observed in the county by most of those who were privileged to see it on that occasion.

(357) EASTERN PIGEON HAWK. *Falco columbarius columbarius*. A rare migrant, not more than one being seen every three or four years.

There is a specimen in the Saunders collection taken within the city limits, on April 17th, 1885.

(360) EASTERN SPARROW HAWK. *Falco sparverius sparverius*.—Formerly abundant, now very rare. Occasionally occurs in winter.

Average date of spring arrival (15 years), March 22nd; earliest, March 1st, 1920.

Nesting records: set of five, May 21st, 1902, fresh; set of four, May 8th, 1902, fresh; set of five, May 20th, 1904, incubation well advanced; set of five, May 30th, 1904.

(300) EASTERN RUFFED GROUSE. *Bonasa umbellus umbellus*.—Although not nearly so common as in the days when the country was all wooded, a few may still be found principally in the large cedar swamps.

They occasionally wander far from their usual haunts, one having been seen in Victoria Park, London, on December 28th, 1915, at 8 a.m. In March of the following year one was seen several times within a

block of the park, possibly the same bird, although if so where it stayed during the intervening period is a mystery.

Nesting dates: set of ten, June 6th, 1890, incubation just begun; set of thirteen, April 9th, 1897; set of nine, May 12th, 1916, incubation one-fifth; set of thirteen, May 20th, 1928, eggs not taken.

(289) EASTERN BOB-WHITE. *Colinus virginianus virginianus*.—Used to breed quite commonly throughout the county, but their numbers became sadly depleted until they almost disappeared. The recent protection accorded this species has resulted, however, in restoring them to a measure of their former abundance. Severe winter weather and illegal shooting tend to keep their numbers down and they are still far from common in most localities.

The only nesting date available is a set of twelve, on June 6th, 1890, fairly fresh.

(309.1) RING-NECKED PHEASANT. *Phasianus colchicus torquatus*.—For some years settings of eggs have been distributed throughout the county by the Government. These birds have been released and it is now not an uncommon sight to see them in the fields or along the roadside. Some of them are exceedingly tame. One day we stopped our car to watch one walking by the side of the road. It came up on to the road, feeding as it came, walked deliberately under the car, crossed the road and continued on into a field on the other side.

It is doubtful if these birds are pure bred *torquatus*. There is probably a strain of *colchicus* blood in them.

(310a) EASTERN TURKEY. *Meleagris gallopavo silvestris*.—Turkeys were formerly abundant throughout the district but are now, of course, extirpated. So far as we know there are no specimens, although there is one egg in the Saunders collection that was taken locally.

Robert Elliott reports that the last one seen alive at Plover Mills was in 1870.

The *List of Birds of Western Ontario* (Morden and Saunders), published in 1882, states, "formerly common, now very rare".

The last birds heard of near London were near Arva in the fall and winter of 1885.

On October 30th, 1906, John Oliver, Kilworth, said that 1886 was about the last date for that region. He had seen very many of them at Kilworth.

"Formerly quite common. A nest was found in Delaware township in 1878, with thirteen eggs" (W. E. Saunders in the *Annual Report of the Entomological Society of Ontario*, 1891).

Hypothetical. (206) SANDHILL CRANE. *Grus canadensis tabida*.—"The London (Ontario) Advertiser says that George Jackson of that city, while on a shooting expedition recently, shot a splendid specimen of the Sandhill Crane of fine plumage, rare birds in this part of the country. Handed over to Mr. Mummery for mounting". "Rare Birds for Canada". *Forest and Stream*, 7: 212, November 9th, 1876.

The locality where this specimen was taken is not known, but it is doubtful that it was in Middlesex County. The record is given here as above reported, but the species has been put on the hypothetical list.

(208) KING RAIL. *Rallus elegans elegans*.—"On January 17th, 1902, I visited Clifford Zavitz, Coldstream, at his home. He told me that Bear Creek was dammed at Coldstream until 1901 and that two large rails spent the early summer of 1900 in the marsh. He selected the King Rail from my collection and was positive that was the bird." (Notes W. E. Saunders.)

Robert Elliott reports one observed at Plover Pond but no date is given. (Macoun's *Catalogue of Canadian Birds*.)

Roger T. Hedley reports (1928) that he flushed one from beside a spring on the roadside at home a few summers ago, but did not make a note of the date.

A rather unusual record, that of a winter bird, is a male taken on December 20th, 1921, at Saunders' Pond. There was no open water at the time, the bird having been found among the rushes along the shore amidst ice and snow. It is now in the Saunders collection.

(212) VIRGINIA RAIL. *Rallus limicola limicola*.—A regular but not common migrant, seldom seen, probably because we do not wade the marshes enough. It nests in the locality, a set of ten eggs having been taken on May 24th, 1915, in Caradoc by W. R. Campbell, and another set of nine on May 25th, 1916, at Coldstream by A. A. Wood.

Average date of spring arrival (4 years), May 7th; earliest, April 29th, 1913.

(214) SORA. *Porzana carolina*.—The commonest rail.

Average date of spring arrival (16 years) May 5th; earliest, April 26th, 1915.

A. A. Wood reports one nest containing fifteen eggs which were piled up in two layers, May 29th, 1916. The only other nesting date available is a set of seven, fairly fresh, June 24th, 1902.

(215) YELLOW RAIL. *Coturnicops noveboracensis*.—Norval G. Jones and J. C. Higgins, on September 21st, 1908, found one dead on the road

one mile east of London. It was given to W. E. Saunders and is now in his collection.

One was heard calling in a swamp in West London, on May 19th, 1920, by John A. Morden. It was there the next day but although we heard it we were unable to flush the bird from the reeds. The note was like that produced by striking two pebbles together.

One was killed in migration at Grand Bend on October 11th, 1906. This, of course, is not in Middlesex County, but as the Yellow Rail is a rare bird it may be well to place this occurrence on record in these notes.

(219) FLORIDA GALLINULE. *Gallinula chloropus cachinnans*.—So far as our experience goes, the Florida Gallinule is rare or irregular or both. Never more than one seen each year, although seen sometimes several days in succession, and very often one or two years may elapse without any record at all.

The date of arrival varies from May 1st (1914) to May 24th (1920), the average over a period of eight years being May 13th; earliest, May 1st, 1914, as above noted.

(221) AMERICAN COOT. *Fulica americana americana*.—A fairly common migrant in spring and fall. Of recent years they seem to be increasing somewhat, flocks of 12 or 15 being occasionally seen at the "Ponds" in the fall. They remain in the spring until the end of May and become very tame. No doubt they would remain to breed if undisturbed.

Average date of spring arrival (11 years), April 20th; earliest, March 27th, 1916.

A. A. Wood reports having captured young birds on the pond at Coldstream, and also having seen an adult which got into a cellar at Poplar Hill in midsummer. This was before he kept records so no dates can be given for these occurrences but the birds presumably nested in the vicinity.

(274) SEMIPALMATED PLOVER. *Charadrius semipalmatus*.—Not common. Only a few spring records and not seen very much oftener in the fall, usually only two or three birds at a time. They have, however, been noted more regularly and frequently during the past three or four years, due perhaps to more intensive work on the part of our fieldmen. The largest flock we ever saw in either spring or fall was recorded from the Lambeth pool on May 22nd, 1927, when there were twenty present.

(273) KILLDEER. *Oxyechus vociferus vociferus*.—Common summer resident. One of the earliest birds to arrive in the spring, their wild ringing cries usually being heard before the snow and ice have all disappeared. They stay until quite late in the fall, often being seen in November. Although they come so early and stay so late we have no winter record for the species.

Average date of spring arrival (17 years), March 13th; earliest, February 23rd, 1922.

Nesting records: set of four, May 5th, 1898, fresh; set of four, June 8th, 1901, fresh; set of four, June 17th, 1905, incubated two-thirds; set of four, April 30th, 1907; set of four, June 26th, 1908, nearly fresh; set of four, June 1st, 1912.

(272) AMERICAN GOLDEN PLOVER. *Pluvialis dominica dominica*.—First seen by W. E. Saunders in September, 1878. In succeeding years, until about 1882 or 1883, there were flocks of them in the fall in the commons north and east of the city (London). There is no record between that date and September 19th, 1904, when two were taken by Roger T. Hedley at Duncrief. There have been no records since the latter date.

(270) BLACK-BELLIED PLOVER. *Squatarola squatarola*.—Very rare in both spring and fall. No specimens in local collections, but there are a number of sight records, the most recent, also the largest number reported, being a flock of seven about ten miles north of London, on May 26th, 1924. Heavy rains had partly flooded a wheat field and the plover remained there for a couple of days, in company with some Semipalmated Sandpipers.

(283a) RUDDY TURNSTONE. *Arenaria interpres morinella*.—"July 30th, 1897, during a heavy thunder storm at Lambeth, 6 miles southwest of London, a farmer named Thorncroft, just after supper, heard a tremendous clap of thunder. Thinking his barn had been struck he rushed out but instead of finding his barn in flames he saw six white objects falling through the air. On picking them up he found them to be Turnstones not yet dead, but all soon died. He brought one to me, the others were wasted. Evidently the birds were in the path of the electrical discharge and if he had not gone to the door just then he could never have learned the cause of death as none of them showed any injury." (Notes W. E. Saunders.)

This is the only record for the county.

(228) AMERICAN WOODCOCK. *Philohela minor*.—These birds arrive from the south in early spring as soon as the frost is out of the ground

sufficiently for them to obtain food. From then until late in May their spectacular evening flight song may be heard in suitable localities where they remain to breed.

A. A. Wood says, "I saw a nest with four unfertile eggs on May 10th, 1915. The bird allowed me to stroke her head before leaving. Evidently just the female was present that year as during repeated waits in early April nothing was heard of the male. Only one bird was seen all season".

Owing to the difficulty of getting out to their haunts sufficiently early in the season, our record of first arrivals is not very extensive. Four years show an average of March 30th; earliest, March 27th, 1921.

Nesting dates: set of four, April 14th, 1890, fresh; set of four, May 10th, 1915, unfertile; set of three, May 30th, 1919, incubated about one-quarter.

(230) WILSON'S SNIPE. *Capella delicata*.—Common during both spring and fall along the margins of ponds and streams, or in open pastures containing small pools where they may find food. They have an interesting spring flight song although it is not as spectacular as that of the Woodcock.

Average date of spring arrival (13 years), April 12th; earliest, March 27th, 1925.

No doubt some remain to breed in the vicinity. Roger T. Hedley informs us that they have been at his place every summer for twenty-five years. The only positive nesting record, however, is a set of four eggs taken by A. A. Wood on the Hedley farm, Duncrief, May 2nd, 1924. This set and nest are in the Royal Ontario Museum of Zoology, Toronto.

There are several winter records. One was seen on January 13th, 1923, along the river four miles west of London, where the ground had been kept open by a spring. It was there again on January 20th, but on too close approach it flushed and although the locality was examined on subsequent occasions it was not seen again.

On December 6th, 1926, one was picked up on Oxford St., in the city of London, by D. D. York. It was numb with the cold and although it revived somewhat when taken into the house, it died through lack of suitable food a few days later. It was not preserved.

On February 17th, 1929, one was found in a wet ditch about a mile north of Byron. It flew away, calling as it went.

On December 28th, 1929, one was listed in our Christmas Census report. It was found by J. C. Higgins in a boggy place within the city limits. We looked for it again on New Year's Day but a thaw in the interval had altered conditions and we were unable to find it.

A correction. Species now referred to the hypothetical list.
(264) LONG-BILLED CURLEW. *Numenius americanus americanus*.—In the *List of the Birds of Western Ontario* (Morden and Saunders), published in *The Canadian Sportsman and Naturalist*, December, 1882, we read, "Formerly occurred as far inland as Middlesex, probably never now". This is the only note regarding this species and it would seem that there is now no certainty that the reference is not to the Hudsonian Curlew.

(265) HUDSONIAN CURLEW. *Phaeopus hudsonicus*.—The first definite record, and the only specimen for the county, is a bird shot by L. H. Smith, at Strathroy on September 22nd, 1900. It is now in the Saunders collection.

The species was not again recorded until May 24th, 1927, when in the "Goldenwing Woods" on our Victoria Day round-up, one flew overhead calling. Waders were much commoner than usual in the spring of 1927, first spring records having been made for a number of species.

(261) UPLAND PLOVER. *Bartramia longicauda*.—A. A. Wood, Coldstream, writes that several pairs nest regularly in the large grass fields near there. He has a set of four eggs taken on June 3rd, 1915. W. R. Campbell also has a set of four taken in May, 1914. In both cases it was difficult to flush the bird from the nest. The one in 1915 did not leave until the grass tuft around the nest was touched (and these were fresh eggs). A. A. Wood also took a set of four on May 21st, 1926.

Four miles south of London, at White Oak, several pairs are found regularly each season, but nowhere in the county may they be called common.

Average date of spring arrival (14 years), April 24th; earliest, April 17th, 1915.

(263) SPOTTED SANDPIPER. *Actitis macularia*.—Our commonest sandpiper, to be found everywhere throughout the county.

Average date of spring arrival (17 years), April 22nd; earliest, April 15th, 1912.

A. A. Wood reports an interesting occurrence which might suggest that the number of eggs in a set is perhaps in a small measure voluntarily under control of the bird. A pair of these birds were excavating the slight depression necessary for their nest when they came to a stone practically the same size as an egg. They left this and built the nest round it, then laid three eggs which with the stone made the perfect circle usual with four eggs. He believes that if the stone had been removed at first they would have laid the usual set of four as all other sets found have contained that number.

Nesting dates: set of four, June 13th, 1904, fresh; set of three, June 8th, 1907, fresh, probably incomplete; set of four, May 31st, 1912; set of four, May 26th, 1914; set of four, May 29th, 1914, fresh; set of four, June 14th, 1917.

(256) EASTERN SOLITARY SANDPIPER. *Tringa solitaria solitaria*.—A few are seen each spring but never in very great numbers. In the fall, before conditions were altered, as referred to under the Pectoral Sandpiper, as many as 25 were seen at one time along the river in London West.

The nesting of this species referred to in the *List of Birds of Western Ontario* (Morden and Saunders) 1882, is believed to have been an error.

Average date of spring arrival (14 years), May 6th; earliest, April 21st, 1923.

(254) GREATER YELLOW-LEGS. *Totanus melanoleucus*.—A few usually seen and heard each spring. Commoner in the fall.

Average date of spring arrival (13 years), April 21st; earliest, April 13th, 1923.

(255) LESSER YELLOW-LEGS. *Totanus flavipes*.—Quite rare in spring but common in the fall, usually in August.

Average date of spring arrival (6 years), May 4th; earliest, April 16th, 1918.

(234) AMERICAN KNOT. *Calidris canutus rufus*.—Mr. Knolls, of Delaware, had two Knots mounted which he claimed were killed there by striking telephone wires. This is the only record for the county. These are lake shore birds and it is believed they fly high between lakes, and the destruction of these by wires can only be regarded as very extraordinary.

(239) PECTORAL SANDPIPER. *Pisobia melanotos*.—Very rare in spring. Until 1928 the only records were one taken by W. E. Saunders on April 2nd, 1915, while canoeing down the river, and two seen and heard flying over in the vicinity of the "Ponds" on April 30th, 1925. In 1928, however, we had the good fortune to find a flock of 40 near White Oak, on April 28th, while in 1930 a flock of 20 was noted in a grassy hollow a mile north of Lambeth, the date being May 4th.

In the spring of 1931 they were positively abundant. Possibly our experience of the previous two or three years had taught us how, where and when to look for them, or else a change of route led them through our district in greater numbers than usual. They were first noted on April 10th and from then until the middle of May we found Pectorals

in a dozen different places, in fact it became quite unusual not to find them in any suitable wet, grassy field. The flocks varied in numbers from two or three individuals up to thirty or forty, and their abundance was freely commented upon by naturalists in other places in Ontario as it would appear as if Pectorals were, as a general rule, looked upon as rare birds during the spring migration.

(See *The Canadian Field-Naturalist*, 46: 190, November, 1932, "Spring records of Pectoral Sandpiper at London, Ontario", by W. E. Saunders).

We used to see a few every fall but recently their occurrence has been considered an outstanding event. There is no very suitable place for waders around London and our records are correspondingly irregular. For a number of years the drain from a local manufacturing plant evidently carried to the river certain products that produced conditions relished by the waders, and every autumn we made many interesting records there, but for some time now that spot seems to have lost its charm for the birds and few of them are seen. Possibly the sewage is now being treated before being dumped into the river so that the place is no longer attractive to them.

(240) WHITE-RUMPED SANDPIPER. *Pisobia fuscicollis*.—"On May 15th, 1929, at the pool on the corner, a mile north of Lambeth, I studied a sandpiper carefully, and at pretty short range (25 yards), and, believing him to be a White-rump, I flushed him and saw the white tail coverts clearly as he flew away." (Note W. E. Saunders.)

This is the first and only record for the county.

(241) BAIRD'S SANDPIPER. *Pisobia bairdi*.—A rare fall migrant, being seen only once in every three or four years. An exceptional year was 1930 when they were rather common in the fall migration.

The first spring records were made in 1927 which was a notable year for waders around London. Three were observed on May 18th at a pool near Lambeth, and on May 24th two more were noted at the same place. On May 31st, 1930, one was found along the river near Delaware in company with a number of other small sandpipers.

(242) LEAST SANDPIPER. *Pisobia minutilla*.—A few pass through during the latter part of May but they are much commoner during July and August, their arrival then being one of the first signs of the fall movement in the bird world.

Average date of spring arrival (5 years), May 17th; earliest, May 14th, 1923.

(243a) RED-BACKED SANDPIPER. *Pelidna alpina sakhalina*.—A rare autumn migrant, being seen only occasionally in the London district.

A. A. Wood states that two came to the pond at Coldstream on October 15th, 1917, one of which was secured.

The Lambeth pool which gave us so many records in the spring of 1927, produced the first spring Red-backs, two being there on May 22nd.

In 1931, C. G. Watson added another spring record when he found a single bird of this species along the river near Wonnacott's farm on May 24th.

(231) EASTERN DOWITCHER. *Limnodromus griseus griseus*.—This bird is one of the latest to be added to the county records. On May 18th, 1927, Mrs. E. H. McKone and Mrs. E. M. S. Dale discovered a flock at a pool near Lambeth, about seven miles south-west of the city (London). Realizing they had made a find, of the uniqueness of which they were not quite certain, they telephoned for "help" which arrived in the person of the male members of the Bird Club shortly after work at 5 p.m. There were twenty-six Dowitchers in full spring plumage in the pool, besides a number of other waders, and the whole scene, the sky, the setting sun, with the birds keeping up a continual chatter of conversation amongst themselves, thrilled us through and through. (See *The Canadian Field-Naturalist*, 43:63, March, 1929, "The Dowitcher at London, Ontario", by E. M. S. Dale.)

We also have one autumn record, two birds found at a small pool about two miles south of London on September 6th, 1929.

(233) STILT SANDPIPER. *Micropalama himantopus*.—When we added the Little Blue Heron to the county list on August 2nd, 1930, we did not think it would be followed in less than two weeks by another new species.

On August 15th, C. G. Watson and the junior author visited a small but very attractive pool on the 2nd concession, Westminster Township, just west of the Wellington Road, to see what might be there in the way of waders. A considerable area of mud had been exposed by the dry weather and there was a small but nicely assorted flock of birds present, including one that we were unable to name. We finally decided that it was a Stilt Sandpiper, but, being entirely unfamiliar with that species, we noted it very carefully so that we could make a final decision when we returned home and referred to plates and description. These left no doubt that our surmise had been correct, and as the bird was accommodating enough to remain over until the next day, others of the Bird Club were enabled to see it also, including the senior author. It was fortunate indeed that so many other species were present with which to compare it for size, colour and other markings as, had it been alone, it would have been no doubt passed by as a Lesser Yellow-legs, a species

which it closely resembles. Another was found on September 1st at the Denfield pool, which had given us so many other interesting records during the summer and fall of 1930.

In 1931 we had Stilt Sandpipers especially in mind as we felt that, perhaps, they had been overlooked heretofore through some carelessness in observation. Weather conditions were very different from the previous year, however, and no really good, lasting place for waders was found during the summer. There was one that held forth some promise but although it dried up in the course of a very few days, before it finally ceased to function it gave us one record for the present species, the date being August 11th, and the observer W. E. Saunders.

(246) SEMIPALMATED SANDPIPER. *Ereunetes pusillus*.—Seen occasionally during the spring migration but more commonly in the fall. They are usually a little later in arrival at both seasons than the Least Sandpiper. They are also commoner than that species, the largest flock being 25 at the Wonnacott Farm on June 1st, 1929.

Average date of spring arrival (4 years), May 19th; earliest, May 6th, 1922.

(248) SANDERLING. *Crocethia alba*.—It seems strange that a shore bird so common in adjoining counties should have remained off the Middlesex list for so many years. Possibly the reason may be the absence of sandy beaches which are its favourite haunt. On September 1st, 1930, one was noted busily feeding along the muddy edge of a pool a mile south of Denfield in company with other waders of various species. It was examined with field glasses at close range by the authors.

(222) RED PHALAROPE. *Phalaropus fulicarius*.—In August, 1930, we visited Stuart Ovens, Maple Lodge, to interview him regarding certain records. He showed us a specimen of the Red Phalarope, in the autumn plumage, which had been taken by his brother Arthur on a pool on the farm some 25 or 30 years ago. This is the only record for the county.

(223) NORTHERN PHALAROPE. *Lobipes lobatus*.—Two were taken by Adam Coulter at the pool in the spruce swamp, three miles west of London, prior to 1882. One of the specimens is now in the Saunders collection.

The species was not again noted until 1930, the following account of that occurrence being taken from the notes of E. M. S. Dale.

"September 20th, 1930. On our way to the Bird Club corn roast to-day we drove round by way of the Denfield pool to see what might be there. As we neared it we saw a small sandpiper swimming about near

the west side that we at once knew was a Phalarope. The next question was to determine the species. It was only some fifteen or twenty feet away and in splendid light, so we remained in the car (to which it paid no attention) and examined it closely, making notes so that we might be able to complete the identification when we had access to specimens and books. It had a heavy dark line through the eye, white underparts, back mottled black and white and grey, black bill, and white wing bars. The latter were quite noticeable as it half flew over the surface of the pool snapping up insects. It was very active as the feeding appeared to be good. When we got home and referred to written accounts there seemed to be no doubt that it was a Northern Phalarope. The wing bars ruled out Wilson's, while the size and colour of the bill, also the colour of the back precluded the possibility of it being a Red. We then journeyed out to the picnic, causing great excitement when we announced our find. Many left at once for Denfield and were successful in finding the bird. Others waited until the next morning but it was then too late as the Phalarope had moved on during the night."

(42) GLAUCOUS GULL. *Larus hyperboreus*.—Accidental. Only a single record of one, a female of the second year, shot near Hyde Park by Will Elson on February 1st, 1901. It had been feeding on the carcass of a dead cow for some days. It is now in the Saunders collection.

(51a) HERRING GULL. *Larus argentatus smithsonianus*.—May be found at any time during the winter when there is open water, coursing up and down the river looking for something to eat. Later on, in the spring, they may be seen almost every day flying over singly or in small flocks of half a dozen or so, heading for the north. On May 25th, 1925, one was observed flying over a wood four miles west of London, a very late date, as usually none are seen after the first or second week of May, although twenty-five miles to the south, at Port Stanley (Lake Erie) there are hundreds around the breakwater all summer long. They may frequently be seen at the "Ponds" in the early spring, standing on the ice, before there is any sign of open water to entice them there. Probably the reason for their early arrival, also for the large number seen in 1926 and 1927 (as many as two hundred at one time) may be found in the garbage-strewn fields just to the north.

(54) RING-BILLED GULL. *Larus delawarensis*.—One often suspects the Ring-billed amongst the Herring Gulls seen on the Thames, but positive identification is always difficult and usually impossible.

On April 10th, 1925, when canoeing on the Thames from Ingersoll to London, we saw two gulls standing side by side on a rock in the

middle of the river. The difference in size was quite noticeable and gave us our first positive sight record for the Ring-billed Gull for the county. On April 17th, 1926, three Ring-billed Gulls were seen playing in the water just below Komoka bridge. They were identified by the size, there being Herring Gulls close by with which to compare them. The next day, April 18th, there were three at the "Ponds" in a flock of about one hundred Herring Gulls. In addition to the difference in size we could plainly see their yellow feet and legs as they stood on the ice. In 1929 a flock of six or eight was seen on the river just below Komoka bridge on March 29th, while the following year, on April 5th, some four or five were observed at the same place.

For those who demand a bird in the hand before allowing a record to stand, we might state that one was shot by Mr. Elson, Sr., from the mill at Byron on November 27th, 1903. It was almost in adult plumage except for some dark shading on the neck. The specimen has, however, been lost.

(60) BONAPARTE'S GULL. *Larus philadelphia*.—In July, 1890, one was shot at the waterworks just west of the city of London. A. A. Wood, Coldstream, reports that two came in the spring of 1900, one of which was shot but not preserved. There is, however, a specimen taken by R. T. Hedley, Duncrief, April 26th, 1902, now in the collection of J. H. Fleming, Toronto.

Recent sight records from near London are as follows:—April 24th, 1920; April 7th, 1921; April 14th, 1922; May 6th, 1924; April 15th, 1929; April 29th, 1930; one bird on each occasion. These birds were all seen at the group of small ponds just south of London and were identified by the small size, dark head and distinctive wing pattern. Sometimes they would be found resting on the water, at other times flying up and down, and in the case of the 1924 bird, after flying up and down it alighted on the top of a dead stub and remained there for some time paying no attention to us whatever.

In 1926 they were present in record numbers. On April 30th four were seen at the "Ponds" and a few days later John A. Morden reported a flock of twenty at the same place. On the whole, though, Bonaparte's Gull may be considered a rare bird with us.

(70) COMMON TERN. *Sterna hirundo hirundo*.—Quite common on Lake Erie, 25 miles to the south, but rare inland. One was seen at the "Ponds" on May 20th, 1921, and on May 17th, 1925, three were observed on the River Thames at Kilworth bridge by C. G. Watson and Mr. and Mrs. E. H. McKone. One was again observed at the "Ponds" on May 16th, 1930, also by C. G. Watson. On May 24th, 1931, Will Girling saw one flying along the river, near Byron.

There are two Middlesex specimens, a male and a female, shot on September 12th, 1904, by R. T. Hedley, Duncrief, and now in the collection of J. H. Fleming, Toronto.

(64) CASPIAN TERN. *Hydroprogne caspia imperator*. There is no Middlesex specimen of the Caspian Tern, the following sight records being all we have to entitle it to a place on the list.

On the morning of September 15th, 1916, J. F. Calvert was in his garden in the south part of the city (London), when his ears were saluted by a note with which he had become very familiar while summering at Sturgeon Lake, Victoria County, Ontario. On looking up he saw the author, a Caspian Tern, flying over at quite a height. Mr. Calvert has had quite a number of years' experience with these birds on their fall migration through the Kawartha Lakes region and feels quite sure of the identification. (See *The Canadian Field-Naturalist*, 33: 55, Sept., 1919, "Nesting of the Caspian Tern in the Georgian Bay", by W. E. Saunders.)

The second and last occurrence was on May 3rd, 1926. We went out to the "Ponds" as usual, although the morning was rough and stormy, and were well rewarded by seeing a Caspian Tern. It flew past the party at close range and we were able to see quite easily the characteristic down-pointing head armed with the heavy red bill.

(77) BLACK TERN. *Chlidonias nigra surinamensis*. One specimen, taken by R. T. Hedley at the Duncrief mill pond April 30th, 1902, the first record for the county, is now in the collection of J. H. Fleming, Toronto.

The bird is one that is easily identified and the following sight records may be of interest. John A. Morden reports that two flew over him at the "Ponds", June 19th, 1924. In 1926 the species was seen twice, May 21st one at the "Ponds", and May 28th two on the river just behind the Victoria Hospital, London. In 1927 one was seen at this latter point, standing on the very same rock, the date being May 12th. (See *The Canadian Field-Naturalist*, 43: 63, March, 1929, "Black Tern at London, Ontario", by E. M. S. Dale.) On May 11th, 1929, J. F. Calvert saw one at the "Ponds", while in 1931 another was noted at the same place on the morning of May 19th.

(31) BRUNNICH'S MURRE. *Uria lomvia lomvia*.—In one of the periodical inland flights of this species, one dropped into the Thames within the limits of the city of London and was shot by J. Hevey on December 10th, 1894. It is now in the Saunders collection.

(316) EASTERN MOURNING DOVE. *Zenaidura macroura carolinensis*.—Common summer resident and very generally distributed. Occasionally a few stay all winter.

Average date of spring arrival (17 years), March 28th. Earliest, March 17th, 1921.

Nesting dates: set of two, April 23rd, 1896, fresh; set of two, April 30th, 1898; set of two, May 5th, 1904, incubated one-quarter; set of two, June 11th, 1907, incubation slight; set of two, May 23rd, 1914; set of two, May 17th, 1917.

(315) PASSENGER PIGEON. *Ectopistes migratorius*.—Many people still living can recall the time when the flights of Passenger Pigeons darkened the sky. They are, of course, extinct now. Some of the most recent occurrences as taken from the notes of W. E. Saunders are:

"Sept. 24th, 1885. Saw four Passenger Pigeons, shot three. This rather points to these birds having raised two young as the specimens taken were a female and two young."

"April 2nd, 1892. Two at Walker's pond."

A later record is found in the minute book of the McIlwraith Ornithological Club, page 99, under date of June 6th, 1902, from which we quote as follows:—"A letter from Mr. R. Hedley was read reciting the passage of 400 to 500 wild pigeons over his farm on May 22nd, 1902. His father who was with him at the time was very familiar with this bird in the later days of its abundance".

So far as we know there are no eggs that were taken locally although there are quite a number of specimens of the birds themselves in different collections.

Hypothetical. (382) CAROLINA PAROQUET. *Conuropsis carolinensis carolinensis*.—About 1877 Russell Burnett went up to the "Valley", at the head of Maitland St., London, and shot a yellow and green parrot out of a tree. The specimen was not preserved, and although it probably was a Carolina Paroquet, there is now no proof, and the species is therefore placed on the hypothetical list.

(387) YELLOW-BILLED CUCKOO. *Coccyzus americanus americanus*.—Common, breeds. One of the latest migrants to appear. Sometimes does not come until June.

Average date of spring arrival (17 years), May 22nd. Earliest, May 8th, 1912.

Nesting records: set of three, June 26th, 1895, fairly fresh; set of five, June 7th, 1902, incubated one-half to three-quarters; set of three, June 17th, 1902, incubated one-quarter; set of three, June 8th, 1912; set of three, June 17th, 1916, incubation well advanced.

(388) BLACK-BILLED CUCKOO. *Coccyzus erythrophthalmus*.—Common, breeds. Like the Yellow-billed, this is a late migrant.

Average date of spring arrival (14 years), May 22nd. Earliest, May 9th, 1913.

Nesting records: set of three, June 19th, 1891, fresh; set of three, June 9th, 1908, fresh; set of four, June 1st, 1912.

(365) BARN OWL. *Tyto alba pratincola*.—The first record for the county was a bird caught near Newbury in the winter of 1901-1902. It was kept alive until January, 1903, when it died. W. Gould skinned it and gave it to W. E. Saunders, in whose collection it now is.

The species was not again reported until April, 1923, when E. Boug, Brick St., London, shot one that had been living in his barn. The specimen was mounted by J. J. B. Meyers and when last heard of was in the possession of William Marsh.

Another was taken on December 18th, 1925, by G. F. Kennedy in his father's barn, about two miles north of Hyde Park. The specimen is still in his collection.

(373m) EASTERN SCREECH OWL. *Otus asio naevius*.—The commonest owl, being well distributed both in the city and also in the country. A pair have lived for some years in the squirrel boxes in Victoria Park, London. In early spring, as the shades of night begin to fall, the owl may be seen with its head sticking out of the door. Sometimes, too, one of them may be seen in the doorway at midday with the sun shining brightly on it, and once the bird was noticed right out on the doorstep of the house as if taking a sun bath. In 1924 they raised six young which took as their day-time perch the limb of a maple tree overhanging the sidewalk on Wellington St. Droppings on the walk below called the attention of passers-by, many of whom took a friendly interest in the owl family.

Other nesting records are: set of four, taken by W. A. Balkwill, on May 5th, 1900, six feet up in a beech tree, on Tecumseh Ave., London. W. A. Balkwill also found a nest in McArthur's woods, by the Coves, fifteen feet up in a beech, on May 22nd, 1921, which contained four young. Also a set of five was taken by Clifford Zavitz, at Coldstream, date unknown.

(375b) ARCTIC HORNED OWL. *Bubo virginianus subarcticus*.—Specimens of this variety have been taken by A. A. Wood, as follows:
February 8th, 1918, a female, in the collection of J. H. Fleming, Toronto.
February 26th, 1918, a female, in the collection of the American Museum of Natural History, New York.
March 4th, 1918, a male, in the National Museum of Canada, Ottawa.
March 6th, 1919, a male, in the collection of W. E. Saunders, London.

(375) GREAT-HORNED OWL. *Bubo virginianus virginianus*.—Fairly common throughout the county. They nest early, beginning to lay in the latter part of February.

A. A. Wood reports that on April 28th, 1914, on climbing to a Great Blue Heron's nest he was surprised to find a young Horned Owl nearly ready to fly. In a heron's nest a few rods away was another young owl. He tried this bird but it could not fly. Presumably the old bird moved the one to the second nest, perhaps when they became quarrelsome. Evidently the other nest was appropriated after the herons took possession as a pair of herons were building a new nest; the other twenty-one herons' nests were all occupied.

Nesting records: set of two, March 19th, 1901, incubation just begun; set of three, March 21st, 1902, two unfertile, one almost hatched; set of two, March 26th, 1903, almost hatched; set of two, April 1st, 1904, one unfertile, one almost hatched; set of two, February 25th, 1915.

(376) SNOWY OWL. *Nyctea nyctea*.—The first record is one seen by W. E. Saunders in the city of London, in December, 1880. It flew down Clarence St. and across Dundas St. Some eight or ten were reported during the winter of 1890-1891. A. A. Wood saw one near Strathroy, on December 24th, 1917. He also obtained one in the flesh shot by Mack Whillans, at Vanneck, on November 6th, 1918. Other specimens, too, have been taken from time to time.

At the November, 1902, meeting of the McIlwraith Ornithological Club, Fred. V. Langford spoke of a Snowy Owl which had spent at least a part of the summer near the 6th concession of London Township, just west of the graded side-road.

In common with other points, the London district had a great invasion of Snowy Owls during the winter of 1926-1927. At least half a dozen were captured and presented to the Springbank zoo, and many others were shot, some being preserved, the others thrown away. Before their numbers became thinned out by the hunters, two or three might be seen in one day on a drive through the country.

The winter of 1930-1931 saw another invasion though on a somewhat smaller scale. Rabbit hunters accounted for several that we know of, while others were seen in various parts of the county, a farmer near Ilderton noting two at one time.

The only specimen in the Saunders collection was shot by John Sullivan, Kerwood, on January 9th, 1902.

Hypothetical. (377a) AMERICAN HAWK OWL. *Surnia ulula caparoch*.—The only reference to this species is contained in the *List of Birds of Western Ontario* (Morden and Saunders), 1882, which states "Very rare. One bought in the flesh in

London 187 = . (E. W. Sandys)." This was presumably taken in Middlesex County though we cannot, of course, be sure and it is thought best to put this species on the hypothetical list.

Another record on about a par with the above appears in the minute book of the McIlwraith Ornithological Club for June, 1902. "The Secretary read a letter from Stuart Ovens stating that he had then what he took to be a Hawk Owl." There was no information as to where the specimen was taken; added to which Ovens evidently was not sure of the identity of the bird.

(368) NORTHERN BARRED OWL. *Strix varia varia*.—Wm. Pope, who travelled throughout this district in 1833, tells in his diary of being kept awake at night by owls. His description leaves very little doubt that they were Barred Owls. In those days, of course, the country was heavily wooded. The clearing up, incident to settlement, has changed conditions so that now the Barred is probably our rarest owl. One was seen by W. E. Saunders at the "Ponds", on October 22nd, 1918, this being the first record for many, many years. None have been reported since.

(370) GREAT GRAY OWL. *Scotiaptex nebulosa nebulosa*.—The only record of this species is that given in the *List of Birds of Western Ontario* (Morden and Saunders), 1882, where it is noted that two, shot near London, are in the possession of S. Herring, Toronto. No date is given.

The minute book of the McIlwraith Ornithological Club for June, 1902, states that the secretary read a letter from Stuart Ovens, Maple Lodge, saying that he had stuffed what he took to be a Great Gray Owl, about twelve years ago. Its whereabouts, also the location taken, are unknown. We cannot now even be sure that the bird really was a Great Gray Owl, but have given this extract from the Club's minutes for what it may be worth.

(366) LONG-EARED OWL. *Asio wilsonianus*.—This little owl is frequently commoner in a locality than is suspected, owing to its strictly nocturnal habits; most of the local cedar swamps have a pair.

The following nesting records have been reported by A. A. Wood: set of five, May 1st, 1916, incubation very slight. This was no doubt a second laying due perhaps to the first set having been destroyed, as at least three other fresh sets were found on April 1st. One nest found on March 30th contained two eggs, the only bare place was where the bird sat, the nest being covered with about three inches of snow. Young birds remain in the nest until the last week in May.

A nest found by W. E. Saunders, on May 17th, 1907, seven miles north-east of London, was in a pine tree, situated as a Sharp-shin's nest. It was composed of twigs, leaves, pine needles and own feathers. Height, 35 feet. Cubic contents of the eggs, 20, 22.3, 22.7 and 24 cc. The birds were both there and one, presumably the female, used a rhythmic squealing note like a Gnatcatcher might make, and an occasional hoot on *e* or *f*. The squawk was certainly a queer sound, "*sweiah, sweiah*". The female (?) flew near and eyed the intruder carefully at fifteen yards, then flew into a thick tree and squawked a great deal for some little time.

(367) SHORT-EARED OWL. *Asio flammeus flammeus*.—They are sometimes fairly common (the summer of 1925 in the vicinity of Duncrief, for instance) and are occasionally present throughout the fall and winter. As they occur at all seasons of the year they doubtless breed here although the nest and eggs have never been found. The nearest we have to a nesting record is the report of a farmer's boy near Duncrief, who says he saw some downy young.

An interesting record was made during our Christmas Census trip on December 26th, 1931, when a flock of eight was flushed in a field about ten miles north of London.

Hypothetical. (371) RICHARDSON'S OWL. *Cryptoglaux funerea richardsoni*.—Mr. Lamotte, Strathroy, had an owl brought to him in the winter of 1906-1907 which he had stuffed. It was apparently Richardson's by his description. No trace of it can now be found.

A Richardson's Owl was in the Holman collection which was purchased by the National Museum of Canada. This is strong though not positive evidence that the bird was obtained near London.

As neither of the above records is at all positive, the species has been classed as hypothetical.

(372) SAW-WHET OWL. *Cryptoglaux acadica acadica*.—It would be hard to say just how rare or how common the Saw-whet Owl really is. They are certainly very seldom reported, but yet every few years somebody shoots one, or brings one in, or else someone has a case of stuffed birds containing a little owl of which they do not know the name, so it would appear that perhaps they occur every year in limited numbers but remain undiscovered owing to their small size and secretive habits. Young birds have been seen in summer so they must breed here, too, although the nest or eggs have never been taken.

There are three specimens in the Saunders collection taken on March 30th, 1908, November 13th, 1909, and November 1st, 1913. A. A. Wood took one on November 2nd, 1913.

On March 8th, 1888, W. E. Saunders heard his first one at Komoka. On March 14th, 1914, a party was organized to go to Komoka swamp for the avowed purpose of again listening for Saw-whets. Luck was with us. The bird was first heard at 7.05 p.m. A bird was seen flying south-east about 7.30 p.m., but although it was too dark to be certain, we took this to be the owl because the next time it called it was due south of the first location. It called again at 8.25 p.m., starting low, increasing in volume, called twenty-nine times, slight pause, then fifteen times, silence. Although we have gone to Komoka, also other places, many times since we have never seen or heard a Saw-whet again.

(417) EASTERN WHIP-POOR-WILL. *Antrostomus vociferus vociferus*. A fairly common summer resident.

Average date of spring arrival (11 years), April 28th. Earliest, April 23rd, 1925.

In June, 1883, a set of eggs was taken in Komoka swamp by A. P. Saunders, while a nest containing two eggs was found by J. F. Calvert, in the Hamilton Road swamp, five miles east of London, about 1912. These eggs were not taken. These seem to be the only two available nesting records although the birds breed here regularly.

(420) EASTERN NIGHTHAWK. *Chordeiles minor minor*.—Common summer resident. Formerly lived in the country but now largely found in the cities where the gravel roofs of large buildings seem to afford satisfactory nesting sites.

Average date of spring arrival (17 years), May 15th. Earliest, May 5th, 1917.

Nesting records: set of two, June 22nd, 1902, fresh, found on the ground in the country; set of two, June 26th, 1909, fresh, found on the roof of the Grand Opera House, London.

(423) CHIMNEY SWIFT. *Chatura pelagica*.—Very common summer resident. A. A. Wood (Coldstream) reports that they nest in silos, granaries or in the barns in the siding, as often as they do in chimneys. During migrations they sometimes collect in thousands to roost in large chimneys.

Average date of spring arrival (17 years), April 24th. Earliest, April 16th, 1912.

Nesting records: set of three, June 29th, 1896, fresh; set of five, June 24th, 1900; set of four, July 9th, 1912.

(428) RUBY-THROATED HUMMINGBIRD. *Archilochus colubris*.—Common summer resident. A member of the McIlwraith Ornithological

Club, J. C. Middleton, had the hummingbirds that came to his garden so tamed that they would come to his hand to feed on syrup contained in a small bottle.

Average date of spring arrival (17 years), May 14th. Earliest, May 6th, 1916.

Nesting records: set of one, June 21st, 1902, fresh, nest deserted; set of two, June 11th, 1907, incubated one-fifth; set of two, June 5th, 1923, fresh.

(390) EASTERN BELTED KINGFISHER. *Megaceryle alcyon alcyon*.—Common, breeds. A few stay over each winter. Spring birds usually arrive about April 3rd.

Nesting records: set of six, May 24th, 1901, fresh; set of seven, May 12th, 1906, incubated one-quarter; set of six, May 18th, 1907, incubated slightly; set of seven, May 17th, 1917.

(412a) NORTHERN FLICKER. *Colaptes auratus luteus*.—Very common summer resident, arriving from the south about March 27th. A few remain over each winter.

Nesting records: set of seven, May 13th, 1901, fresh; set of eight, May 29th, 1902, incubation just begun; set of seven, May 16th, 1906, fresh; set of seven, June 4th, 1912; set of nine, May 18th, 1915.

(405a) NORTHERN PILEATED WOODPECKER. *Geophloeus pileatus abieticola*.—This bird was no doubt quite common in the early days when the country was well wooded. It is rare now, though an odd pair or two still nest where conditions are suitable. In 1912 and 1913 a pair lived in a hundred-acre bush near Wyton, but the bush was cut down and the birds disappeared. Occasionally reported from the Coldstream district. During the winter of 1928-1929 one evidently spent some time just to the west of London, fresh work, unmistakably that of a Pileated, having been found at Wonnacott's farm and also in Springbank Park. Fresh work was again found on the same white cedar tree at Wonnacott's in the spring of 1930, also in the spring of 1931. The bird itself, however, escaped notice.

"Coldstream, two pair nest regularly a few miles south-west of here. One dead beech stub has three nest holes about three or four feet apart, the lowest 45 feet from the ground". (A. A. Wood in *The Canadian Field-Naturalist*, 34: 50, March, 1920).

A nest was taken in Middlesex County, in May, 1885, by Robert Elliott. (McIlwraith in *Birds of Ontario*, 1886.)

(409) RED-BELLIED WOODPECKER. *Centurus carolinus*.—Up until about 1890 the Red-bellied Woodpecker was quite numerous. Now it is very rare. A few pairs still nest within the county, however, and

usually remain all winter. One has come for a number of years to R. T. Hedley, Duncrief, to feed on suet nailed to a tree.

The only nesting record is one egg taken on May 7th, 1913, by A. A. Wood, at Coldstream.

(406) RED-HEADED WOODPECKER. *Melanerpes erythrocephalus*.—Common summer resident. Not infrequently found in winter, too, especially in years when beechnuts are plentiful.

Average date of spring arrival (17 years), May 2nd. Earliest, April 6th, 1918.

Nesting records: set of five, June 8th, 1891; set of seven, May 31st, 1899; set of five, June 8th, 1902, fairly fresh; set of six, June 2nd, 1908, incubation begun; set of four, June 5th, 1912.

(402) YELLOW-BELLIED SAPSUCKER. *Sphyrapicus varius varius*.—A regular and not uncommon migrant spring and fall. In the spring they sometimes stay on until the latter part of May. Although rare in winter they have been noted several times, one having been taken by A. A. Wood in an orchard at Vanneck, on December 12th, 1923.

Average date of spring arrival (17 years), April 7th. Earliest, March 26th, 1925.

The *List of Birds of Western Ontario* (Morden and Saunders), 1882, says, "Quite a number remain to breed".

The diary of Robert Elliott records, "May 24th, 1900; saw a nest in a black ash swamp". The black ash swamps have been destroyed and it is doubtful if the birds now nest here.

There is, however, a set of eggs in the Saunders collection that were taken locally.

(393) EASTERN HAIRY WOODPECKER. *Dryobates villosus villosus*.—A common bird throughout the year.

Nesting records: set of three, May 9th, 1903, incubated two-fifths; set of four, May 2nd, 1904, fresh.

(394c) NORTHERN DOWNY WOODPECKER. *Dryobates pubescens medianus*.—Common throughout the year, much more so than the foregoing species.

Nesting records: set of four, May 4th, 1892; set of four, June 3rd, 1896, fresh; set of three, May 11th, 1903, fresh; set of four, May 18th, 1906, fresh; set of six, May 17th, 1916.

(400) ARCTIC THREE-TOED WOODPECKER. *Picoides arcticus*.—A rather rare visitor, usually in the late fall or winter months. The latest

occurrence, also, perhaps, the most unusual, was one found at London, on May 15th, 1928, a female, which remained in the same locality about a week, during which time a certain dead hemlock tree received a great deal of attention if we may judge by the way the trunk was riddled with holes.

The earliest record is one taken at London in the fall of 1875, as reported in the *List of Birds of Western Ontario* (Morden and Saunders), 1882. One in the Saunders collection was taken at Appin, on December 14th, 1899. W. R. Campbell took a male in 1913, and A. A. Wood took a female on November 20th, 1918. There are also a number of sight records, in addition to the May bird noted above.

(401) AMERICAN THREE-TOED WOODPECKER. *Picoides tridactylus bacatus*.—The only record for this species is one shot in the winter of 1881-1882, in Caradoc township. It was identified by John A. Morden.

(444) EASTERN KINGBIRD. *Tyrannus tyrannus*.—Common summer resident.

Average date of spring arrival (17 years), May 6th. Earliest, April 27th, 1914.

Nesting records: set of three, July 8th, 1892, fresh; set of four, June 8th, 1905, fresh; set of four, June 7th, 1912; set of four, June 17th, 1917.

(452a) NORTHERN CRESTED FLYCATCHER. *Myiarchus crinitus boreus*.—Fairly common summer resident.

Average date of spring arrival (17 years), May 6th. Earliest, April 29th, 1915.

Nesting records: set of five, June 17th, 1901, incubated about one-quarter; set of five, May 30th, 1914, fresh.

(456) EASTERN PHŒBE. *Sayornis phæbe*.—Common summer resident. Our earliest flycatcher.

Average date of spring arrival (17 years), March 24th. Earliest, March 12th, 1923.

Nesting records: set of five, May 10th, 1901, fresh; set of four, May 24th, 1902, incubated two-thirds; set of five, June 7th, 1902, incubated three days; set of six, May 5th, 1909, incubated one-fifth; set of five, April 29th, 1915.

(463) YELLOW-BELLIED FLYCATCHER. *Empidonax flaviventris*.—A rare migrant. Usually not more than two or three seen each season and sometimes missed altogether.

Average date of spring arrival (12 years), May 22nd. Earliest, May 10th, 1914.

(465) ACADIAN FLYCATCHER. *Empidonax virescens*.—"May 26th, 1921. Coldstream—Having become familiar with all the flycatchers which should appear here, except the 'acadian', much time was spent, particularly in the spring, searching for this species. W. E. Saunders had given me the note so accurately that I am really indebted to him for this capture. When I heard this small flycatcher, resembling an 'alder', giving this more 'explosive' note, no time was lost in securing it. Mr. Saunders and Mr. Fleming determined it as an 'acadian'. The bird was taken in a small red elm tree on the bank of the stream below the mill pond. It is now in the collection of J. H. Fleming, Toronto." (Notes A. A. Wood).

This was the first and only record for the county until 1930, when on June 23rd while hunting for orchids, W. E. Saunders found an "acadian" in a swampy wood, south-east of Newbury. The presence of the bird on such a late date leaves little doubt that it was breeding. This locality had probably never before been visited by an ornithologist and the interesting discovery there made has caused us to wonder how many other places in the county may be holding secrets awaiting someone to come and discover them. After all, our efforts cover but a very tiny part indeed of the county and we may be missing many good things but a short distance from the beaten track of our every day endeavour.

(466a) ALDER FLYCATCHER. *Empidonax trailli trailli*.—Fairly common summer resident. Probably the latest species to arrive in spring.

Average date of spring arrival (14 years), May 27th. Earliest, May 15th, 1916.

The only time the nest of the "alder" was ever found here is thus described by W. E. Saunders:—"June 29th, 1908, went for a walk in the willows where this species was heard on the 21st and hunted all through them unsuccessfully, but a few minutes later found the nest ten inches above the ground in a raspberry bush among the willows. The bird flushed off the nest three feet on my right and flew out of the bushes ahead of me, but I looked back and found it. It contained two young and one egg."

(467) LEAST FLYCATCHER. *Empidonax minimus*.—Common summer resident though much diminished in numbers in the last fifteen years.

Average date of spring arrival (17 years), May 6th. Earliest, May 2nd, 1914.

The only nesting record available is a set of four taken June 19th, 1902, fresh.

(461) EASTERN WOOD PEWEE. *Myiochanes virens*.—Common summer resident.

Average date of spring arrival (17 years), May 19th. Earliest, May 11th, 1912.

Nesting records: set of three, July 10th, 1900, incubation just begun; set of three, June 17th, 1901, incubated one-quarter; set of three, June 9th, 1902, fresh; set of three, June 13th, 1904, incubation begun; set of three, July 6th, 1908, incubation just begun.

(459) OLIVE-SIDED FLYCATCHER. *Nuttallornis mesoleucus*.—Although quite common all through Northern Ontario, they do not seem to pass through Middlesex County in any numbers, unless, perhaps, they fly right over the county without alighting. They are one of the latest of the spring arrivals, sometimes not being noted until June. Usually not more than one or two seen each year, and sometimes missed altogether. If any reader of this paper can throw light on the migration route of this species, or explain why a bird so common in the north should be so rare here, we hope they will be good enough to publish their information or views in some suitable periodical.

The few dates we have average (11 years), May 20th. Earliest, May 7th, 1924.

(474k) HOYT'S HORNED LARK. *Otocoris alpestris hoyti*.—J. E. Keays took two on Oxford St., a couple of miles west of the city of London, on December 9th, 1899, the first and only record for the county until A. A. Wood secured specimens at Strathroy in November, 1926, as recorded in *The Canadian Field-Naturalist*, 41: 62, March, 1927, "Some Rare Birds at Strathroy, Ontario", by A. A. Wood. He also secured others the following year. See *The Canadian Field-Naturalist*, 41: 91, April, 1927, "The Horned Larks", by W. E. Saunders.

(474) NORTHERN HORNED LARK. *Otocoris alpestris alpestris*.—Although these may occur more or less regularly every year (since A. A. Wood's experience with them in 1926 and 1927 we have begun to suspect that they may), we never had a definite record previous to November 11th, 1926. On that morning Mr. Wood went afield and secured in one shot two Northern Horned Larks (*Otocoris alpestris alpestris*), and two Hoyt's Horned Larks (*Otocoris alpestris hoyti*) besides a Lapland Longspur. Others were taken later on in the month both by Mr. Wood and also by Roger T. Hedley as recorded in *The Canadian Field-Naturalist*, 41: 62, March, 1927, "Some Rare Birds at Strathroy, Ontario," by A. A. Wood. In 1927 he secured other specimens at about the same time of year. (Also see *The Canadian Field-Naturalist*, 41: 91, April, 1927, "The Horned Larks," by W. E. Saunders.)

(474b) PRAIRIE HORNED LARK. *Otocoris alpestris praticola*.—This species is said to have arrived here about 1860, in its spread eastward, and is now a common summer resident. They appear very, very early in the year, usually a month before there is any other bird movement, February 11th being the average date. Occasionally a few are found throughout the winter. There are days in late February or early March when they are very abundant. On February 26th, 1921, every suitable field seemed to have a flock in it, between 400 and 500 birds having been recorded in a walk of a few miles. A. A. Wood took an albino female, on June 11th, 1917.

It is an early breeder. On April 25th, 1900, a brood of young left the nest able to fly, and once young were found actually hatched in March. Further nesting records: set of four, April 5th, 1902, incubated one-half; set of three, April 1st, 1904, incubation begun; set of five, May 8th, 1912.

(614) TREE SWALLOW. *Iridoprocne bicolor*.—Formerly quite common, but now much less so.

"About 1878 this species nested on the house which still stands at 380 Dundas St., London, where I then lived, and I took sets of eggs at the 'Coves' where they nested in the dead stubs beside the water." (Notes W. E. Saunders.)

A small colony is located at the "Ponds" where they nest each year in old Woodpecker holes or in boxes erected for the purpose.

"April 14th, 1926. Two Tree Swallows at the 'Ponds' to-day although there is only a little open water around the edge. It looked strange to see them flitting over the surface of the ice the same as they do over the water in the summer time. I do not imagine they found many flies as it snowed in the afternoon." (Notes E. M. S. Dale.)

Average date of spring arrival (15 years), April 13th. Earliest, April 2nd, 1920.

This early date, which was taken from records covering the years 1910 to 1926 only, was very badly shattered in 1929 when one was seen at the "Ponds" on March 25th, a record that will likely stand for some time.

(616) BANK SWALLOW. *Riparia riparia riparia*.—Abundant where suitable breeding places are to be found. Colonies numbering thousands are located in the cliffs along Lake Erie, the colonies found inland, of course, being smaller. These birds always make an oval hole for nesting, about one and a quarter inches by two and a quarter inches, the tunnel being from one to three feet in length.

Average date of spring arrival (17 years), May 6th. Earliest, April 28th, 1923.

Nesting records: set of six, May 29th, 1899; set of four, May 25th, 1901, fresh; set of five, June 8th, 1908, fresh; set of five, June 4th, 1912; set of five, June 22nd, 1915.

(617) ROUGH-WINGED SWALLOW. *Stelgidopteryx ruficollis serripennis*.—Common along the streams and rivers of Middlesex County. Nesting holes are not less than three inches in smallest diameter, and nests have been found at all depths. Sometimes they are visible from the outside, and at others forty inches from the outside. The nests are bulky and made of straws, weed stems, roots and small sticks and are usually lined with green willow leaves, but have not, so far, been found with a feather lining, as is usually the case with the Bank Swallow. The eggs are larger than those of that species and are usually in sets of six or seven while the Bank Swallow lays four or five and sometimes six.

Average date of spring arrival (17 years), April 23rd. Earliest, April 17th, 1914.

Nesting records: set of seven, May 30th, 1899; set of five, June 15th, 1900, fresh; set of five, June 4th, 1912; set of six, June 7th, 1915; set of six, June 10th, 1920.

(613) BARN SWALLOW. *Hirundo erythrogaster*.—A common summer resident, probably the commonest, or at least the best distributed of the swallows.

On August 21st, 1901, W. E. Saunders visited a swallow roost in some willows which had been used since at least 1898, and estimated that 20,000 Barn Swallows left it that morning. Arriving at 5 a.m., the first lot, consisting of 500, went out at 5.11; at 5.16, 2,000 left; at 5.22 from 5,000 to 10,000 left. Many came back and one or two more lots went out, the final departure being at 5.37. Included in the grand total of 20,000 (?) were 1 Tree, 2 Bank and 6 or 8 Eave Swallows, which were seen on the wires alongside the road. This roost was discovered in 1898 and was used annually, but the willows were subsequently destroyed and the place, of course, abandoned by the birds.

On October 14th, 1917, a Barn Swallow was observed flying up and down the river Thames at Kilworth, a rather late date for a member of this family to be seen near London.

Average date of spring arrival (17 years), April 18th. Earliest, April 13th, 1916.

Nesting records: set of five, May 29th, 1902, incubated about two-thirds; set of five, June 5th, 1904, fresh; set of three, June 2nd, 1905, heavily incubated; set of five, June 3rd, 1907; set of five, June 15th, 1912.

(612) NORTHERN CLIFF SWALLOW. *Petrochelidon albifrons albifrons*.—Formerly abundant but now quite rare, although where they are given some protection from English Sparrows they continue to return to the same barn year after year.

Average date of spring arrival (12 years), April 30th. Earliest, April 20th, 1916.

Nesting records: set of seven, June 15th, 1891; set of four, May 27th, 1898; set of five, June 2nd, 1915; set of five, May 31st, 1916, partly formed.

(611) PURPLE MARTIN. *Progne subis subis*.—A common summer resident, at least in the city and in the towns and villages, seeming to prefer the proximity of human habitations to the open countryside. This may, perhaps, be accounted for by the fact that it finds nesting sites more readily in crevices in large buildings, and also because houses are frequently put up for its accommodation.

This species has an interesting race with the Tree Swallow each year to see which will be the earliest arrival of the swallow family. It is two days ahead of the Tree Swallow with the average date, but one day behind with the early date, according to the list compiled, covering records to 1926. In 1929, however, a Tree Swallow was found at the "Ponds" on March 25th, which will probably remain a record that either species will have difficulty in breaking for many years to come.

Average date of spring arrival (17 years), April 11th. Earliest, April 3rd, 1913.

Although they nest commonly within the county, we cannot locate any record of the nest or eggs having been taken.

(484) CANADA JAY. *Perisoreus canadensis canadensis*.—On October 26th, 1929, T. D. Patterson added a new bird to the Middlesex list when he found a Canada Jay in South London. The bird was in front of a residence there, flying up and down between a spruce tree and the ground. Mr. Patterson is familiar with the Canada Jay, having seen it many times in the north country. The record is also given strength by the fact that during the fall and early winter of 1929 there was a considerable movement of this species, reports having been received of its occurrence at Toronto and other points to the south of the usual range. (See "The Whiskey Jack", by W. E. Saunders, *The Canadian Field-Naturalist*, 44: 50, Feb., 1930.)

(477) NORTHERN BLUE JAY. *Cyanocitta cristata cristata*.—Although found commonly throughout the year there is apparently some migratory movement with this species as, around the middle of May each year,

flocks of sometimes a dozen or two may be seen flying over, when local birds have their eggs laid. A. A. Wood reports that they gather in the cedar swamps in the late fall and eat large quantities of skunk cabbage seeds.

Nesting records: set of six, May 13th, 1896, fresh; set of five, May 23rd, 1904, fresh; set of four, May 24th, 1908; set of four, April 29th, 1915; set of four, May 10th, 1915.

(486a) NORTHERN RAVEN. *Corvus corax principalis*.—J. A. Morden, who knows this bird well, wrote to W. E. Saunders in the winter of 1882-1883, from Hyde Park, saying that he had heard the croaking of a Raven there last fall (1882), and had often seen it in Lambton County, Brooke Township, also near Petrolia.

(488) EASTERN CROW. *Corvus brachyrhynchos brachyrhynchos*.—Although found commonly throughout the year, there is some migratory movement evident in early spring. During the first few warm days Crows may be seen straggling along in loose flocks sometimes all day, usually heading in a north-easterly direction.

Nesting records: set of five, April 19th, 1901, incubation just begun; set of four, April 19th, 1902, fresh; set of four, April 27th, 1904, fresh; set of five, April 17th, 1905, fresh; set of four, April 24th, 1906.

(735) BLACK-CAPPED CHICKADEE. *Penthestes atricapillus atricapillus*.—A common resident, although usually much more noticeable in the winter than in the summer. Possibly at that season their numbers are augmented by wandering flocks coming in from the north. In some winters they come into the city in goodly numbers, but are seldom, if ever, found there during the summer months.

The only nesting record available is a set of six taken on May 18th, 1916.

(740) HUDSONIAN CHICKADEE. *Penthestes hudsonicus hudsonicus*.—One was watched for a considerable time at close range by W. E. Saunders, near London, on January 27th, 1907. It was with a mixed flock of Black-capped Chickadees and Redpolls. This is the first record for the county.

Not heard from again until the fall and winter of 1919, when there was somewhat of a visitation of them. Two were taken by A. A. Wood at Coldstream, a male on October 31st and a female on November 28th, both of which are in the collection of J. H. Fleming, Toronto. Two others lived most of the winter in the city of London, one feeding with other birds at George Gillespie's, Albert St., and the other at E. H.

McKone's, Wortley Road south. It was very easy to pick out the "brown-cap" even at some distance by its movements, which were very much more deliberate than those of the "black-cap".

The two specimens taken by A. A. Wood were sent to Washington for identification and have been determined as the dark Labrador race, *Penthestes hudsonicus nigrescens*. P. A. Taverner claims, however, (*The Canadian Field-Naturalist*, 43: 79, April, 1929), that the darker birds are juveniles and should not be recognized as a distinct sub-species. We are, therefore, rather at a loss to know just where to place our birds.

(727) WHITE-BREASTED NUTHATCH. *Sitta carolinensis carolinensis*.—A common resident.

Nesting records: set of eight, April 30th, 1902, incubated four or five days; set of eight, May 9th, 1904, fresh; set of seven, May 11th, 1907, fresh; set of eight, May 7th, 1913, incubated one-third.

(728) RED-BREASTED NUTHATCH. *Sitta canadensis*.—A migrant in spring and fall though not usually very common. In some winters a few remain over, frequently at some food shelf.

Average date of spring arrival (12 years), May 3rd. Earliest, April 13th, 1910.

(726) BROWN CREEPER. *Certhia familiaris americana*.—Usually common during the fall, winter and early spring, but they nearly all go farther north to breed, being rare as summer residents.

"A nest of young found nine miles from London in June, 1880". W. E. Saunders in the *Annual Report of the Entomological Society of Ontario*, 1891.

John A. Morden (on being interviewed in 1928), stated that he had found three nests but could not give any particulars of the dates.

(721) EASTERN HOUSE WREN. *Troglodytes aedon aedon*.—A very abundant summer resident.

Average date of spring arrival (17 years), April 26th. Earliest, April 18th, 1920.

Nesting records: set of seven, May 22nd, 1896, fresh; set of seven, June 10th, 1915; set of seven, June 4th, 1916.

(722) EASTERN WINTER WREN. *Nannus hiemalis hiemalis*.—A common migrant in spring and fall though no doubt often overlooked owing to its diminutive size and secretive habits. When singing, there is, of course, no chance of passing them by.

Average date of spring arrival (16 years), April 11th. Earliest, March 31st, 1913.

There are a number of winter records, the first being January 7th, 1911, one in Springbank Park. Then on the Christmas Census trip, December 23rd, 1922, J. F. Calvert found one in a little ravine near the river at Hyde Park. On January 7th, 1923, after a period of heavy snow and some zero weather, we took a snowshoe tramp to the place to see if the bird was still there. We found it in the same spot and followed it for a short distance as it flitted from root to root where the little stream had worn away the soil. There were very few places where it could find an opening as everything was pretty well snowed-up and frozen-up. We do not know if it managed to survive the winter or not—in fact, we wondered how it managed to exist as long as it did. In the winter of 1928-1929, Eastern Winter Wrens were well represented in the London district. Two were noted on the Christmas Census trip while others were seen at various times and places throughout January and February.

It breeds in small numbers where conditions are suitable, having been heard in song during the summer months both in Dorchester swamp and also at Wonnacott's farm, near Delaware.

"A single nest found with one egg. Not uncommon in deep cedar swamps". (W. E. Saunders in the *Annual Report of the Entomological Society of Ontario*, 1891.)

(719) BEWICK'S WREN. *Thryomanes bewicki bewicki*.—The first specimen for Canada was taken by W. E. Saunders on December 12th, 1898, near Appin, in a swampy area full of brush and fallen trees, with a few shrubs. There was scarcely a foot of light snow on the ground and the day was clear but not very cold. The bird was feeding and working along through upturned roots and piles of brush. This is the only record for the county. (See *The Canadian Field-Naturalist*, 33: 118, December, 1919, "The Status of Bewick's Wren in Ontario", by W. E. Saunders.)

(718) CAROLINA WREN. *Thryothorus ludovicianus ludovicianus*.—A number of records, some of which follow:

A. A. Wood reports that a male came to Coldstream in the spring of 1916, which remained in full song until August. One spent the summer of 1919 at London, living in the north end of the city in the vicinity of St. Joseph's Hospital. It was first heard on May 29th. In 1927 one was heard several times during April and May at Wonnacott's farm, near Delaware, and probably stayed all summer. On June 26th of the same year, W. E. Saunders was awakened one morning by a strange song coming from his garden. He was unable at the time to locate the singer, but later on in the day found the bird to be a Carolina Wren. It seldom gave the typical song of the species but rather a medley of songs, including

the Baltimore Oriole, Winter Wren, House Wren and Mourning Warbler. It was gone the next day. (See *The Canadian Field-Naturalist*, 41: 138, September, 1927, "Unusual Song from a Carolina Wren", by W. E. Saunders.)

On May 17th, 1931, one was both seen and heard at Wonnacott's farm.

(725) PRAIRIE MARSH WREN. *Telmatodytes palustris dissaepius*.—The first record for this species was a bird picked up dead on the streets of London on May 17th, 1898, the specimen now being in the Saunders collection. The next was one near Fanshaw, living in a grassy marsh during the summer of 1912. No more were recorded until 1920 when a small colony was found in a marsh usually inhabited by "short-bills." We have no extensive cat-tail swamps such as the "prairies" ("long-bills") usually favour, and when they do visit us they live in what might be termed "short-bill" territory. One year (1924) both species were found in the same marsh. Since 1923 they have been observed every year and would appear to be increasing in this district. Although found in a variety of localities, they have now, for three years, been living in a marsh on Wonnacott's farm, near Delaware, and we hope they may locate there permanently.

The nest or eggs have not yet been taken.

(724) SHORT-BILLED MARSH WREN. *Cistothorus stellaris*.—There are several grassy marshes where we look for these birds, but we find them to be very irregular indeed. Either they do not turn up for a season, perhaps even two or three, or else they live in one place one year and in a different one the next.

During the summer of 1931 they were unusually abundant, being reported from five or six locations in the vicinity of London.

A specimen was taken on September 2nd, 1916, by A. A. Wood.

On July 3rd, 1915, we observed one feeding young and by careful watching found the nest. In addition to the young birds it contained one addled egg which was taken by W. E. Saunders.

(703) EASTERN MOCKINGBIRD. *Mimus polyglottos polyglottos*.—In the *Auk*, 13: 344, October, 1896, Dr. J. Dwight, Jr., records a specimen seen but not captured at Strathroy, on July 1st, 1880. The next records of the species are winter birds, the time when Mockingbirds usually wander around. The first was a specimen taken by A. A. Wood, on January 6th, 1921, in R. T. Hedley's orchard, Duncrief, and the next a bird that spent a month or more in and about the garden of E. H. McKone South London. It was first seen early in December, 1922, and came regularly to a feeding shelf until it disappeared in January.

Also see *The Canadian Field-Naturalist*, 37: 116, September, 1923, "The Mockingbird in Ontario", by W. E. Saunders.

(704) CATBIRD. *Dumetella carolinensis*.—An abundant summer resident. In June, 1914, during the period when the moon was full, a Catbird, living in the junior writer's garden, was in the habit of singing in the middle of the night. On June 9th it began about 11 p.m. and kept it up until after midnight, singing at intervals of ten or fifteen minutes, and giving the full song almost as well as in the daytime.

W. R. Campbell records one wintering in the season of 1918-1919. One also remained during part of the winter of 1927-1928 at J. C. Middleton's, Base Line, London. It came to the feeding shelf and seemed to get on all right on a diet of suet. It was last seen on January 4th. Another was seen near Byron by J. F. Calvert, on December 25th, 1931.

Average date of spring arrival (17 years), May 3rd. Earliest, April 24th, 1921.

Nesting records: set of five, May 25th, 1901, fresh; set of four, June 4th, 1906; set of four, June 11th, 1913; set of four, May 31st, 1915.

(705) BROWN THRASHER. *Toxostoma rufum*.—A common summer resident.

Average date of spring arrival (17 years), April 17th. Earliest, April 3rd, 1922.

Nesting records: set of three, July 6th, 1900, incubation just begun; set of five, May 25th, 1901, fresh; set of four, June 21st, 1901, fresh; set of four, June 8th, 1912; set of four, May 10th, 1913.

(761) EASTERN ROBIN. *Turdus migratorius migratorius*.—One of our most abundant birds, especially in the city. A few stay over each winter.

A. A. Wood reports two albinos hatched from the same nest at Lobo in the spring of 1915. One was practically white, the other had a dark head. The white one became very tame as food was put out for it daily. It returned the next spring but soon disappeared.

Average date of spring arrival (17 years), March 9th. Earliest, February 20th, 1915.

Nesting records: set of four, June 17th, 1901, almost hatched; set of four, April 29th, 1903, incubated one-quarter; set of four, April 28th, 1905, incubated slightly; set of five, May 11th, 1907, fresh; set of four, May 30th, 1915, incubated slightly.

(755) WOOD THRUSH. *Hylocichla mustelina*.—A fairly common summer resident. A. A. Wood finds this species at Coldstream com-

moner as a breeding bird than the Veery, but the opposite seems to be the case near London.

Average date of spring arrival (16 years), May 9th. Earliest, May 3rd, 1913.

Nesting records: set of three, May 18th, 1901, fresh; set of three, June 14th, 1905, incubated two days; set of four, May 31st, 1906; set of four, June 7th, 1912; set of four (plus one Cowbird's), June 2nd, 1915.

(759b) EASTERN HERMIT THRUSH. *Hylocichla guttata faxoni*.—A common migrant in spring and fall.

Average date of spring arrival (17 years), April 6th. Earliest, March 26th, 1925.

The *List of the Birds of Western Ontario* (Morden and Saunders), 1882, states that this species was common in full song in Komoka swamp in June, 1882. No nests were found but they were undoubtedly breeding. None have been observed in summer in any other locality.

(758a) OLIVE-BACKED THRUSH. *Hylocichla ustulata swainsoni*.—A common migrant in spring and fall.

Average date of spring arrival (17 years), May 10th. Earliest, April 24th, 1926.

(757) GRAY-CHEEKED THRUSH. *Hylocichla minima aliciae*.—A regular though rare migrant, not usually more than one or two observed each season and some years missed altogether, probably owing to the difficulty of identification.

Average date of spring arrival (11 years), May 20th. Earliest, May 11th, 1924.

Correction. (757a) BICKNELL'S THRUSH. *Hylocichla minima minima*.—Macoun's *List of Canadian Birds*, 1909, states that Robert Elliott took one specimen on September 19th, 1898, determined as being of this species. This skin has since been submitted to H. C. Oberholser, of Washington, D.C., who refers it to *minima aliciae*. It seems desirable, therefore, that this correction should now be made known.

(756) VEERY. *Hylocichla fuscescens fuscescens*.—A common summer resident.

Average date of spring arrival (17 years), May 6th. Earliest, May 2nd, 1912.

Nesting records: set of two (plus two Cowbird's), June 26th, 1902, incubated one-half; set of three, May 23rd, 1904, fresh; set of four (plus

one Cowbird's), May 22nd, 1905, fresh; set of three, June 4th, 1906, heavily incubated; set of four, May 31st, 1912, fresh.

(766) EASTERN BLUEBIRD. *Sialia sialis sialis*.—A common summer resident, and although one of the earliest spring migrants has never been found here in winter.

Average date of spring arrival (17 years), March 10th. Earliest, February 21st, 1915.

Occasionally sets of white eggs are found and we have one instance of a pair using a swallow hole in the river bank, the nest having been found by W. A. Balkwill in May, 1889.

Nesting records: set of four, March 27th, 1893, fresh (earliest ever found, J. R. McLeod); set of six, April 30th, 1902, fresh; set of four, May 10th, 1903, fresh; set of four, May 8th, 1912; set of five, June 12th, 1917.

(751) BLUE-GRAY GNATCATCHER. *Poliophtila caerulea caerulea*.—Formerly a fairly common summer resident but of recent years they have become quite rare.

Average date of spring arrival (12 years), May 11th. Earliest, May 2nd, 1913.

Nesting records: set of five, May 28th, 1900; set of four, May 24th, 1902, fresh; set of five, May 24th, 1902, incubation begun; set of four (plus one Cowbird's), June 7th, 1902, incubation begun; set of four, May 19th, 1903, fresh.

(748) EASTERN GOLDEN-CROWNED KINGLET. *Regulus satrapa satrapa*.—A very abundant migrant, some remaining over winter although their numbers usually thin out pretty well by February.

Found several times in late May, the only actual breeding record, however, having been in the year 1915 when some hours' careful watching and searching disclosed a nest, twelve feet up, six feet out from the trunk, fastened among the pensile branchlets of a white spruce in the Oxford St. (Proudfoot's) Cemetery, a mile west of London. This illustrates the desirability of planting native trees, as a larger cemetery nearby, containing more spruces, none of them native, has never been known to harbour these birds in summer.

On July 30th, 1930, Eli Davis found a flock of a dozen or more, in the spruce swamp near Byron, evidently birds that had bred there. This is one of the most likely places in the county in which to find Kinglets in summer on account of the stand of black spruce that it contains. Summer birds have been found there on at least two previous occasions.

(749) EASTERN RUBY-CROWNED KINGLET. *Corthylio calendula calendula*.—A common migrant in spring and fall.

Average date of spring arrival (17 years), April 15th. Earliest, April 5th, 1921.

(697) AMERICAN PIPIT. *Anthus spinoletta rubescens*.—Rather rare during the spring migration, somewhat commoner in the fall. On October 12th, 1924, we saw three or four, from a flock of about a dozen, alight in a dead tree beside the "Ponds". They only remained a moment or two, then rejoined their companions in the air. If the proportion of those calling to those silent in this flock, held good for all those heard during the early morning of this day, between fifty and seventy-five must have passed over in an hour or so.

Average date of spring arrival (10 years), May 5th. Earliest, April 10th, 1924.

(618) BOHEMIAN WAXWING. *Bombycilla garrula pallidiceps*.—A very rare winter visitor. About 1875, W. Hine took several specimens on Clarence St., just south of Queens Ave., London. Harry Gould took one in September, 1890, in the east end of the city. In 1920, A. A. Wood secured two males on January 30th in an orchard at Coldstream, which are now in J. H. Fleming's collection. On the same day, Dr. E. H. Perkins found a small flock along the river about a mile west of London, while R. T. Hedley recorded a flock of sixteen on February 3rd a few miles south of Coldstream and a flock two miles east of Duncrief the week before. On April 12th, 1923, R. T. Hedley reported about a dozen around the shrubs near his home. These appear to be all the records we have of this species.

(619) CEDAR WAXWING. *Bombycilla cedrorum*.—Very erratic. Liable to be seen at any time throughout the year. In some winters they are very abundant, in others entirely absent. The birds which breed here in summer arrive early in May.

Nesting records: set of four, August 20th, 1883; set of five, August 23rd, 1890; set of three, August 2nd, 1892, fresh; set of three, June 15th, 1901, incubated four days; set of three, July 5th, 1902, incubated about one-half.

(621) NORTHERN SHRIKE. *Lanius borealis borealis*.—A rather rare winter visitor. Sometimes two or three are reported during the season, but more frequently only one is met with, and often two or three years slip by without even one having been recorded. During the winter of 1930-1931 they were unusually numerous, however, probably more having

been seen that winter than during the previous ten or even fifteen years. Some were even bold enough to invade the city (London), having been reported several times in the residential district not far from the heart of the city.

During the latter part of their stay (February-March) they may often be heard in song, quite a pleasing effort resembling parts of the Catbird's or Robin's song, together with sundry squeaks and squawks that might have had a Blackbird for their author.

(622e) MIGRANT SHRIKE. *Lanius ludovicianus migrans*.—Fairly common in former years, much less so now. There are one or two fields near London where we find a pair each year, but they are not often seen except in these particular localities.

These birds are usually silent. Once the junior writer was investigating a nest, containing eggs, in a thorn bush. The owners were nowhere to be seen. After leaving the bush and walking away a few paces he turned round to find that the birds had arrived and had evidently been sitting on a twig just overhead while the investigation was in progress. Even though their treasures were in danger they gave no vocal evidence of alarm. In fact, the only time we have any record of their uttering any notes was on May 24th, 1928. On that occasion we were in the same field where the nest above referred to was found. On entering the field we heard a clear whistle that reminded us of a Sandpiper's note. On tracing this to its source we found the Shrike sitting on a fallen dead apple tree. It flew as we approached and alighted on a thorn bush. The next note heard resembled that of a Nighthawk. It flew again and as it was on the wing it uttered a rolling call similar to that given by the Bartramian Sandpiper, a bird which, by the way, lives in the same field as the Shrike.

Average date of spring arrival (12 years), April 3rd. Earliest, March 15th, 1911.

Nesting records: set of five, June 4th, 1898; set of six, May 5th, 1900; set of five, April 27th, 1907, fresh; set of four, May 4th, 1907; set of six, May 9th, 1912.

(493) STARLING. *Sturnus vulgaris vulgaris*.—Although found in adjoining counties in 1921 and 1922, the Starling was not officially recorded for Middlesex until February 17th, 1923. On that date several were seen around a dump in the north end of the city of London. The next day seventeen were counted, and a man living in the vicinity stated that they had been there since December. When spring arrived they scattered to the surrounding country to nest, but succeeding winters found a flock at the same place, in slightly larger numbers each year. During the spring and summer they may be seen occasionally in family parties con-

taining young, and in the fall may also be seen frequently flocking with blackbirds, or sometimes in flocks containing their own species only. They have increased enormously, a flock of 3,000 having been recorded, on October 16th, 1927, from the head of Maitland St., London, a favourite roost for the blackbirds and their allies in autumn.

The first set of eggs was not taken until May 6th, 1928, when Eli Davis secured a set of six from an old woodpecker's hole, in a stub overhanging a pool, near Komoka. They were quite fresh. The nesting cavity was lined with wheat chaff.

(628) YELLOW-THROATED VIREO. *Vireo flavifrons*.—A regular summer resident but not nearly so common as formerly.

Average date of spring arrival (16 years), May 6th. Earliest, April 29th, 1921.

Nesting records: set of four (plus one Cowbird's), June 11th, 1900, incubated about one-sixth; set of four, May 21st, 1902, incubation just begun.

(629) BLUE-HEADED VIREO. *Vireo solitarius solitarius*.—A regular and fairly common migrant.

Average date of spring arrival (17 years), May 6th. Earliest, April 27th, 1921.

It is interesting to note that the Yellow-throated Vireo, Blue-headed Vireo and Eastern Warbling Vireo have exactly the same average date of arrival. There is, too, but very little difference in the early date, two of the species being tied on that also.

(624) RED-EYED VIREO. *Vireo olivaceus*.—A common summer resident.

Average date of spring arrival (17 years), May 14th. Earliest, May 4th, 1916.

"June 8th, 1918. I noticed a 'red-eye' excited over something, then saw a chipmunk climbing the sapling the bird was in. When he was about eight feet up the Vireo darted down, knocking him to the ground. The other bird was on the nest at the end of one of the branches. The nest contained four Cowbird's eggs and one of their own, so little was gained in keeping the chipmunk away." (Notes A. A. Wood.)

Nesting records: set of three (plus one Cowbird's), June 14th, 1901; set of three, June 7th, 1902, fresh; set of two (plus two Cowbird's), June 11th, 1902; set of four, May 29th, 1914, fresh; set of one (plus four Cowbird's), June 8th, 1918.

(626) PHILADELPHIA VIREO. *Vireo philadelphicus*.—A regular migrant but usually not more than one or two seen each spring. Possibly,

if they were strikingly marked, or if the song did not so much resemble that of other Vireos, we might record them oftener. They are the latest of the family to arrive.

Average date of spring arrival (12 years), May 20th. Earliest, May 11th, 1924.

(627) EASTERN WARBLING VIREO. *Vireo gilvus gilvus*.—Fairly common throughout the county. Formerly abundant along the city streets and in the parks in London, but since the introduction and spread of the grey squirrel, this species has made its exit along with the Least Flycatcher, Cedar Waxwing, Red-eyed Vireo, and others.

Nests always high up, not less than 25 feet from the ground, while the "red-eye" seldom builds higher than eight feet, and usually less. The male bird takes his share of the incubating and sings freely while sitting.

Average date of spring arrival (17 years), May 6th. Earliest, April 27th, 1915.

Nesting records: set of four, June 4th, 1877; set of four, June 18th, 1892, fairly fresh; set of two, June 15th, 1907, fresh; set of three (plus two Cowbird's), June 14th, 1916.

(636) BLACK AND WHITE WARBLER. *Mniotilta varia*.—Common in the spring migration, a few remaining to breed, every cedar swamp having its quota. A few also sometimes found in pine woods.

Average date of spring arrival (17 years), April 30th. Earliest, April 24th, 1925.

A nest was found at Hyde Park by W. E. Saunders in May, 1881. It contained two young birds in addition to two Cowbirds, as recorded by J. A. Morden in the *Auk*, April, 1884. There is another nesting record, that of a set of five (plus one Cowbird's egg), found at Komoka, on June 9th, 1882. No nests have been found recently.

(637) PROTHONOTARY WARBLER. *Protonotaria citrea*.—The following is an account of the only record we have for this species:

"On May 20th, 1920, at 5.25 a.m., my attention was attracted by the notes of a Swamp Sparrow coming from a large elm tree. Such an unusual happening demanded an investigation, but before the singer could be located he flew down into some willows bordering the pond and close scrutiny with the glass disclosed the fact that he was a Prothonotary Warbler". (Notes W. E. Saunders.)

For a fuller account of this occurrence, also for other records of this bird in Canada, see *The Canadian Field-Naturalist*, 34: 156, November, 1920, "The Prothonotary Warbler at London", by W. E. Saunders.

(639) WORM-EATING WARBLER. *Helminthos vermivorus*.—"On May 28th, 1908, while walking through woods a few miles west of London, my attention was arrested by a song like that of a Chipping Sparrow coming from a location where no 'chippy' ought to be. I shot the bird, which proved to be a Worm-eating Warbler, the only Canadian record for the species. The specimen is now in my collection." (Notes W. E. Saunders.)

(642) GOLDEN-WINGED WARBLER. *Vermivora chrysoptera*.—A fairly common summer resident.

Average date of spring arrival (17 years), May 11th. Earliest, April 28th, 1915.

Nesting records: set of four, June 8th, 1912, incubation just begun; set of five, June 2nd, 1914, incubation just begun.

There is a wood some five miles west of London where this species is to be found regularly, to which we have given the name of the "Golden-wing Woods", and which is frequently referred to in these notes.

(641) BLUE-WINGED WARBLER. *Vermivora pinus* (see addenda).

(647) TENNESSEE WARBLER. *Vermivora peregrina*.—One of the later warblers but usually well represented in the spring migration. Their loud and characteristic song readily identifies them. Sometimes ten or a dozen are heard in one morning.

Average date of spring arrival (16 years), May 14th. Earliest, May 9th, 1916.

(646) ORANGE-CROWNED WARBLER. *Vermivora celata celata*.—Probably the rarest of the regular migrant warblers, and rather difficult to identify unless one gets a very favourable opportunity to study it. Usually not more than one or two seen each year, and occasionally missed altogether. We are sometimes attracted to this bird by the song, a Chipping-Sparrow-like trill, which aids considerably in its identification.

Average date of spring arrival (12 years), May 16th. Earliest, May 11th, 1921.

(645) NASHVILLE WARBLER. *Vermivora ruficapilla ruficapilla*.—A fairly common migrant. Some remain to breed.

List of the Birds of Western Ontario (Morden and Saunders), 1882, states, "Breeds commonly in swamps, mostly evergreen, where there is a thick growth of moss on the ground, in which the nest is placed".

Average date of spring arrival (17 years), May 5th. Earliest, April 28th, 1915.

"A single nest was found by William Saunders, in the spruce swamp near London, in 1882." Recorded in the *Annual Report of the Entomological Society of Ontario*, 1891.

To the Nashville belongs the distinction of being the only warbler to be reported in winter from Middlesex County. On January 10th, 1932 (a few days, in fact, beyond the date when this paper was intended to close), Eli Davis found a warbler along a wet, bushy hillside just below Byron bridge, which later proved to be a Nashville. The winter of 1931-1932 was unusually mild which may, possibly, have induced this bird to remain in the north. Attempts were made the next day to collect it, but it could not be found again.

(648a) NORTHERN PARULA WARBLER. *Compsothlypis americana pusilla*.—A regular migrant but not common.

Average date of spring arrival (16 years), May 11th. Earliest, May 4th, 1912.

List of the Birds of Western Ontario (Morden and Saunders), 1882, simply says, "Breeds". The basis on which this statement was made is that the birds were heard singing in June in Komoka swamp.

(652) EASTERN YELLOW WARBLER. *Dendroica aestiva aestiva*.—A very common summer resident.

Average date of spring arrival (17 years), April 29th. Earliest, April 20th, 1919.

Nesting records: set of four, May 24th, 1902, fairly fresh; set of four, May 30th, 1914; set of five (plus two Cowbird's), May 27th, 1915; set of five, June 1st, 1916.

(657) MAGNOLIA WARBLER. *Dendroica magnolia*.—An abundant migrant.

Average date of spring arrival (17 years), May 10th. Earliest, May 5th, 1912.

Although the nest and eggs have never been taken, this species may possibly breed as a male was taken on June 8th, 1882, as recorded in the *List of the Birds of Western Ontario* (Morden and Saunders), 1882.

(650) CAPE MAY WARBLER. *Dendroica tigrina*.—Up to the closing years of the last century this appears to have been a rare species, but about the year 1900 it became more common and is not now regarded as rare.

Average date of spring arrival (15 years), May 7th. Earliest, April 26th, 1918.

(654) BLACK-THROATED BLUE WARBLER. *Dendroica caerulescens caerulescens*.—A fairly common migrant.

Average date of spring arrival (17 years), May 10th. Earliest, May 3rd, 1914.

Although the nest and eggs have never been found, A. A. Wood reports having seen this species in summer once or twice. *List of the Birds of Western Ontario* (Morden and Saunders), 1882, records a male in full plumage as having been taken on June 22nd, 1882. It is possible, therefore, that they nest here occasionally.

(655) MYRTLE WARBLER. *Dendroica coronata*.—The earliest warbler to arrive in spring, usually beating the others by a week or two. Very common in both spring and fall but not known to breed.

Average date of spring arrival (17 years), April 19th. Earliest, April 9th, 1921.

(667) BLACK-THROATED GREEN WARBLER. *Dendroica virens virens*.—An abundant migrant and fairly common summer resident in the deep cedar swamps.

Average date of spring arrival (17 years), May 2nd. Earliest, April 24th, 1925.

List of the Birds of Western Ontario (Morden and Saunders), 1882, records a male in full song shot on June 12th, 1882. The nest and eggs, however, have never been taken.

(658) CERULEAN WARBLER. *Dendroica cerulea*.—A regular summer resident but not common and rather local in its distribution. Formerly more abundant than they are now. A number of nests have been taken, varying from 25 to 60 feet above the ground, and all saddled on fairly large limbs from seven-eighths of an inch to two inches in diameter.

Average date of spring arrival (17 years), May 16th. Earliest, May 3rd, 1913.

Nesting records: set of four (plus one Cowbird's), June 16th, 1900, incubated one-fifth; set of four (plus one Cowbird's), June 7th, 1902, fresh; set of four (plus one Cowbird's), June 11th, 1902, one unfertile, remainder incubated three-quarters; set of four, June 17th, 1907, incubation barely begun; set of four, June 8th, 1912, incubation just begun; set of three, June 17th, 1916, incubated one-half.

(662) BLACKBURNIAN WARBLER. *Dendroica fusca*.—A common migrant but rare as a summer resident.

Average date of spring arrival (17 years), May 6th. Earliest, April 27th, 1915.

List of the Birds of Western Ontario (Morden and Saunders), 1882, says, "Breeds, frequents the high trees in swampy districts". The nest and eggs have, however, never been taken.

(659) CHESTNUT-SIDED WARBLER. *Dendroica pensylvanica*.—Not so common as formerly but still breeds in fair numbers.

Average date of spring arrival (17 years), May 10th. Earliest, May 1st, 1916.

Nesting records: set of four, June 18th, 1879, Hyde Park; set of four (plus three Cowbird's), May 27th, 1896, fresh. Nest found with one egg and one Cowbird's about a week before. Three Cowbird's eggs taken out during the week.

(660) BAY-BREASTED WARBLER. *Dendroica castanea*.—This species seems to migrate more or less in a body, being quite abundant on certain mornings during the spring migration, then disappearing.

Average date of spring arrival (17 years), May 15th. Earliest, May 8th, 1924.

(661) BLACK-POLL WARBLER. *Dendroica striata*.—One of the later warblers and usually rare in spring, being much more abundant in fall.

Average date of spring arrival (16 years), May 21st. Earliest, May 13th, 1915.

(671) NORTHERN PINE WARBLER. *Dendroica pinus pinus*.—One of the early warblers but rather rare both as a migrant and also as a summer resident although a few may be found in the pine woods around London each summer.

Average date of spring arrival (14 years), April 29th. Earliest, April 15th, 1922.

The nest and eggs have never been taken although a female was watched gathering nesting material and carrying it to the top of a tall white pine tree, about five miles west of London, on May 10th, 1929.

(673) NORTHERN PRAIRIE WARBLER. *Dendroica discolor discolor*.—"May 30th, 1917. When nearly through our usual 'round' of the 'Ponds', our attention was attracted by an unusual song, 'zee, zee, zee, zee, zee, zee', beginning low and becoming louder and higher. The bird sang quite freely and we had no difficulty in finding it flitting to and fro in the bushes that margined the pond. The light was perfect and the bird so tame that we approached to within fifteen feet of it. We had no trouble in identifying it as a Prairie Warbler (the first record for the county), by the song, tilting of the tail, yellow underparts streaked with black on the

sides, markings on the side of the head, and the chestnut on the back." (Notes E. M. S. Dale.)

"On May 20th, 1919, C. H. Zavitz, Coldstream, told me of having seen a warbler in an orchard that he took to be a 'prairie'. I was on the ground at sunrise the next morning and secured a male." (A. A. Wood.)

On July 13th, 1930, Eli Davis heard a "prairie" singing half a mile west of Mount Brydges. Its presence at this late date would seem to indicate that the bird was nesting.

In 1931, the "prairie" was heard twice near Springbank hill, once on June 19th and again on July 1st. Other visits to the locality failed to disclose it, however, and we finally concluded that it was a wanderer, although it, too, may, perhaps, have been a nesting bird.

(672a) YELLOW PALM WARBLER. *Dendroica palmarum hypochrysea*.—A migrant only and usually not very abundant.

Average date of spring arrival (17 years), April 30th. Earliest, April 21st, 1919.

(674) OVEN-BIRD. *Seiurus aurocapillus*.—A common summer resident.

Average date of spring arrival (17 years), May 4th. Earliest, April 24th, 1916.

Nesting records: set of two, June 8th, 1901, incubated one-third; set of five, May 26th, 1906, incubation barely begun.

(675) NORTHERN WATER-THRUSH. *Seiurus noveboracensis noveboracensis*.—Common in migration while a few remain to breed in retired localities.

Average date of spring arrival (17 years), May 1st. Earliest, April 23rd, 1914.

Our birds are supposed to be intermediate between this species and *notabilis*, although one taken by A. A. Wood, on May 8th, 1917, and which is now in the collection of J. H. Fleming, Toronto, agrees perfectly in both colour and measurements with *notabilis*.

Nesting record: set of four taken, May 30th, 1879, at Hyde Park.

(676) LOUISIANA WATER-THRUSH. *Seiurus motacilla*.—Rare both as migrant and summer resident. One of the earliest warblers to arrive. A pair was found regularly for some years in a wood near Longwoods station. A pair also lived for several years at W. E. Saunders' old farm near Hyde Park, while recently they have been found in several summers at Wonnacott's farm near Delaware. W. R. Campbell took a male four miles west of Coldstream, on June 2nd, 1913.

Average date of spring arrival (5 years), April 25th. Earliest, April 21st, 1917.

(677) KENTUCKY WARBLER. *Oporornis formosus*.—Robert Elliott took the second Canadian specimen near Bryanston on May 16th, 1898. The bird was in a thicket of well-grown thorn trees. The skin is in the Saunders collection. This was the only record for the county until 1931, when a second specimen (the third for Canada), was taken by A. A. Wood, near Strathroy. Mr. Wood's account of this capture is as follows:—

"A trip east in the spring of 1931 kept me away from south-western Ontario from May 13th to 24th. This lost nearly two weeks of bird migration, but, as often happens to an enthusiastic naturalist, the one morning available after returning was to be remembered. Soon after daybreak the morning of the 25th found me in a wooded area two miles north of the town of Strathroy, Ontario, spending a very busy few hours in bringing my neglected migration list to date.

"The thrill of the morning came from following a song which was taken at first for the erratic song of an Oven-bird. The singer was finally collected from the top of a tall maple and proved to be a Kentucky Warbler in full plumage. The bird was found singing in a hardwood bush-plot composed principally of maple and beech, situated on the bank of a creek, a location which has always been good for migrating warblers, particularly the later species. The specimen is No. 3884 in my collection."

(678) CONNECTICUT WARBLER. *Oporornis agilis*.—One of the latest and rarest of the warblers which migrate through here regularly, although on one occasion we heard seven or eight singing in one morning. This, though, is quite unusual. We are generally glad if we hear or see one during the season.

Average date of spring arrival (14 years), May 24th. Earliest, May 20th, 1922.

(679) MOURNING WARBLER. *Oporornis philadelphia*.—A not uncommon summer resident.

Average date of spring arrival (17 years), May 19th. Earliest, May 12th, 1915.

So far as we know the nest and eggs have never been taken.

(681d) NORTHERN YELLOW-THROAT. *Geothlypis trichas brachidactyla*.—A common summer resident.

Average date of spring arrival (17 years), May 7th. Earliest, April 25th, 1925.

Nests have been found in June two or three times. The exact dates, however, are not available.

(683) YELLOW-BREASTED CHAT.—*Icteria virens virens*.—It is hard to know just how to classify the Chat, whether as a rare summer resident, an irregular migrant, or just a straggler.

The first record for this species was one found by C. G. Watson and E. M. S. Dale, about five miles west of London on May 22nd, 1911, in woods known locally as the "Goldenwing Woods". Attention was drawn to the bird by its song and they finally got to within a few feet of it and identified it as above. The woods in which this bird was found seem to be the one most favoured by the Chat in this district for one was found in it again in May, 1912 (in the very same bushy hollow), probably the same bird, although this, of course, cannot be proved.

There is then a gap in our records until May 31st, 1923, when one was found singing in the top of a big cherry tree on a knoll in the same woods, but somewhat to the west of the locality favoured in 1911 and 1912. We saw nothing of it in 1924, but on May 22nd, 1925, one was found in the same woods and the same tree as in 1923. On several of the above occasions the bird remained for some days at least, and in 1911 and 1912 may possibly have stayed all summer.

The next record is one at the "Ponds", on May 17th, 1928, observed by Mrs. E. H. McKone, the only record for this locality.

A later note concerns one, at the "Goldenwing Woods" again, on May 16th, 1930, although in a slightly different place in the woods. It remained several days and was seen by many of the members of the Bird Club.

In 1931, a Chat was again found at the "Goldenwing Woods", by C. G. Watson, on May 27th. Evidently it remained there for the summer as it was both seen and heard on June 16th, this time by W. E. Saunders and F. H. Emery, of Toronto.

For those who do not care to accept records unless established by the bird in hand, it might be stated that a female was taken by Hoyes Lloyd on May 14th, 1918, at Coldstream, No. 1646 in his collection.

(684) HOODED WARBLER. *Wilsonia citrina*.—John A. Morden shot a male, three miles north of Hyde Park, about 1878 to 1882, the first Canadian record. Both date and specimen have been lost.

On May 24th, 1931, the authors went to the "Goldenwing Woods", some five miles west of London, at 7 a.m. We were joined a few minutes

later by Eli Davis. It was fine and bright but a cold north wind blowing and we found birds in good numbers to the south and east where they had some shelter and warmth. After going pretty thoroughly over the bushes there we struck off to the north and when following a path through an open piece of woods trying to get a satisfactory look at a little fly-catcher, our glasses happened to be focused on a warbler that we knew at once was a male Hooded. It proved to be such and gave us every opportunity of examining it at leisure. The trees were not tall and it kept pretty well to the lower branches, remaining in the vicinity five minutes or more. It finally flew away to the south-west, uttering a loud "chip", different, so it seemed to us, to any other warbler we could recall. It sang quite a number of times, a fairly loud song consisting of four notes, the first three the same, followed by one rather more explosive. This is the second record for the county.

(685) WILSON'S WARBLER. *Wilsonia pusilla pusilla*.—A regular migrant, sometimes half a dozen being heard or seen in one morning. Usually only here a day or two.

Average date of spring arrival (16 years), May 19th. Earliest, May 11th, 1922.

(686) CANADA WARBLER. *Wilsonia canadensis*.—A common migrant. Formerly bred regularly but now seldom seen in summer. The cedar swamps which were their chief abode have been nearly all cut down, but wherever a half-open cedar swamp of any size exists they may doubtless be found.

Average date of spring arrival (17 years), May 15th. Earliest, May 5th, 1912.

The only set of eggs on record was taken by W. E. Saunders in the Hamilton Road swamp on June 5th, 1914. It consisted of three eggs (plus one Cowbird's), and was about one-fifth incubated.

(687) AMERICAN REDSTART. *Setophaga ruticilla*.—An abundant summer resident.

Average date of spring arrival (17 years), May 8th. Earliest, April 28th, 1915.

Nesting records: set of four, June 9th, 1901; set of four, June 9th, 1902, fresh; set of four, June 15th, 1907, incubation just begun.

3.2) ENGLISH SPARROW. *Passer domesticus domesticus*.—A permanent resident and decidedly common. First arrived about 1874.

They are thought to be decreasing somewhat since horses have been replaced so largely by automobiles as a means of transportation.

Nesting records: set of four, May 16th, 1905; set of five, May 7th, 1907; set of four, April 24th, 1912; set of six, June 15th, 1912; set of four, June 4th, 1914; set of five, April 5th, 1915; set of five, June 14th, 1916.

(494) BOBOLINK. *Dolichonyx oryzivorus*.—A very common summer resident. One of our happiest recollections in connection with the Bobolink is a chorus of nineteen in a tree by the roadside, on May 4th, 1912. We stopped the car under the tree and listened to them for some time. They finally flew away singing as they went.

Average date of spring arrival (17 years), May 2nd. Earliest, April 25th, 1913.

Nesting records: set of four, June 4th, 1906, fresh; set of five, June 6th, 1907; set of four, June 11th, 1917.

(501) EASTERN MEADOWLARK. *Sturnella magna magna*.—A very common summer resident. A few remain over almost every winter. In the winter of 1922-1923 they were especially common, a flock of seven having been seen, on December 23rd, 1922, near Bryanston.

Average date of spring arrival (17 years), March 16th. Earliest, February 26th, 1922.

Nesting dates: set of three, May 16th, 1905, fresh; set of five, June 28th, 1907, slightly incubated; set of five, May 20th, 1909, fresh; set of five, May 19th, 1912; set of five, May 27th, 1912; set of five (plus one Cowbird's), May 10th, 1913.

(498) EASTERN RED-WING. *Agelaius phoeniceus phoeniceus*.—A very common summer resident. Occasionally one stays all winter, or is at least recorded in winter. Whether the birds survive or not is another question. The majority of nests are found in bulrushes, but often in bushes and once eight feet from the ground in a thorn.

Average date of spring arrival (17 years), March 14th. Earliest, March 5th, 1921.

Nesting dates: set of four, May 17th, 1905; set of four, May 23rd, 1906, fresh; set of four, May 30th, 1907, heavily incubated; set of four, May 26th, 1909, incubation begun; set of four, May 12th, 1914; set of four, June 3rd, 1914, incubated four-fifths.

(506) ORCHARD ORIOLE. *Icterus spurius*.—London is just about at the northern limit of their range and records are, therefore, rather in-

frequent, although *List of the Birds of Western Ontario* (Morden and Saunders), 1882, stated, "At present this is a common bird in Kent and Essex and is becoming more so in Middlesex, having been observed a number of times this year".

The first one was taken by W. E. Saunders, on May 24th, 1880, a male in full plumage. He has seen others occasionally since. A. A. Wood reports one in song on May 31st, 1917.

There is only one nesting record, a set of four eggs taken on June 5th, 1889, by W. McMillan, at Hyde Park. They are in the Saunders collection.

(507) BALTIMORE ORIOLE. *Icterus galbula*.—Common summer resident. Although they seem to prefer the swinging branches of an elm as a nesting site, one nest was noted in Springbank Park in a white cedar.

Average date of spring arrival (17 years), May 5th. Earliest, April 28th, 1915.

Nesting records: set of five, June 5th, 1892, fresh; set of five, June 2nd, 1902, incubated four-fifths; set of five, May 29th, 1914, fresh; set of four, June 3rd, 1914; set of five, June 4th, 1916.

(509) RUSTY BLACKBIRD. *Euphagus carolinus*.—A very common migrant in the fall but much rarer in the spring.

There is one winter record, a bird that in company with a Red-wing, was seen along the river bank near Byron, on January 1st, 1920, and again on January 3rd. The Red-wing was seen once more on January 17th, but it was then alone.

Average date of spring arrival (17 years), March 30th. Earliest, March 11th, 1921.

(511b) BRONZED GRACKLE. *Quiscalus quiscula aeneus*.—A very common summer resident, even invading the city where it nests about buildings. In autumn, flocks numbering thousands roost in the trees at the head of Maitland St., London. A few usually stay over each winter.

Average date of spring arrival (17 years), March 15th. Earliest, March 4th, 1922.

Nesting records: set of five, May 1st, 1901, fresh; set of five, April 25th, 1905; set of four, May 11th, 1906; set of four, May 11th, 1907, fresh; set of six, May 2nd, 1908, fresh; set of six, April 23rd, 1913.

(495) EASTERN COWBIRD. *Molothrus ater ater*.—A very common summer resident, in fact much too common, nearly all species of small

birds being preyed upon by them. Sometimes, in fall, flocks numbering a thousand or more are seen.

There are two winter records. A. A. Wood took a male from a flock of English Sparrows, on December 4th, 1917, while during the winter of 1928-1929 a Cowbird lived near Byron, being seen by a number of different parties. It, also, was quite frequently in the company of *Passer domesticus*.

Average date of spring arrival (17 years), March 21st. Earliest, March 8th, 1921.

(608) SCARLET TANAGER. *Piranga erythromelas*.—A common summer resident. A. A. Wood reports that he took a beautiful male, on June 3rd, 1918, half-way between summer and winter plumage, yet the plumage was full, with no pin feathers. The under parts were the colour of the female with heavy clear-cut blotches of scarlet. The crown, nape and back were variegated with scarlet and green, darker than the crown of the female.

Average date of spring arrival (17 years), May 11th. Earliest, May 2nd, 1915.

Nesting records: set of three, June 5th, 1902, fresh; set of one (plus three Cowbird's), June 9th, 1902; set of one (plus two Cowbird's), June 15th, 1912; set of four, May 30th, 1915.

(593) EASTERN CARDINAL. *Richmondia cardinalis cardinalis*.—The first record for this species was one taken at London, on November 30th, 1896. On November 17th, 1899, John Thompson shot a male at Kilworth. They remained of very rare or casual occurrence until 1910. One spent the winter of 1910-1911, however, in the vicinity of Victoria Park, London, attracting considerable attention. Reports were infrequent during the next two or three years, but since about 1914 they have come to be looked upon as permanent residents, a very delightful addition indeed to our fauna. During the winter of 1916-1917, J. C. Middleton had eight Cardinals feeding at his home on The Ridgeway, London, as well as a variety of other birds. Thirty-one were reported in our Christmas Census for 1929. They often nest within the city in lilac bushes, or other shrubbery, several nests having been collected after the birds had finished with them. During the early spring, in fact usually by the middle of February before winter is over, perched on the tip top of a convenient maple (or perhaps such a prosaic place as a telephone pole) they announce their presence to all and sundry in loud clear whistles that even those not interested in birds cannot fail to notice.

(595) ROSE-BREASTED GROSBEAK. *Hedymeles ludovicianus*.—A common summer resident.

Average date of spring arrival (17 years), May 8th. Earliest, May 3rd, 1913.

Nesting records: set of four (plus one Cowbird's), May 28th, 1902, fresh; set of four, June 15th, 1912; set of four, May 31st, 1913; set of three (plus two Cowbird's), May 27th, 1914, fresh; set of four (plus one Cowbird's), June 1st, 1916.

(598) INDIGO BUNTING. *Passerina cyanea*.—A common summer resident.

Average date of spring arrival (17 years), May 16th. Earliest, May 10th, 1916.

Nesting records: set of five (plus one Cowbird's), June 16th, 1894, fresh; set of three, June 6th, 1902, incubation begun; set of one (plus three Cowbird's), June 11th, 1902, fresh; set of four, June 11th, 1908, fresh; set of four, June 11th, 1913.

(604) DICKCISSEL. *Spiza americana*.—Although the Dickcissel occurred more or less frequently and regularly in the south-western counties up to 1895, the first record of its appearance in Middlesex was in the year 1895 when there was somewhat of a "visitation" of them in Ontario.

About June 17th of that year, Robert Elliott wrote that Joe Beck of Bryanston, had a pair of Dickcissels breeding on his farm and that by careful observation he had found the nest. W. E. Saunders went out to see them on the 21st and on the way, just north of Adelaide St. bridge, about four miles from the city, heard two singing. Going on he came to Beck's and saw the nest and five eggs, one or two speckled with reddish, also the two birds. The nest was well concealed in timothy grass, on a slope. The next day one was heard singing at Lobo Siding, and on July 3rd still another one was both seen and heard on a walk between White Station and Port Stanley (Elgin county). The same year one was reported from Ottawa, at the Experimental Farm.

The species was not again noted until 1930 when A. A. Wood secured a specimen on June 27th. It was heard singing near Strathroy on June 26th and collected the next morning.

(514) EASTERN EVENING GROSBEAK. *Hesperiphona vespertina vespertina*.—A rare and rather irregular winter visitor. A flock of some 75 were reported from the grounds of the Ontario Hospital, London, on March 15th, 1911. We lost no time in going out to see them. They

remained for some days. This is probably the largest flock recorded from this district. There have been various visitations in smaller numbers, however, both before and since that date. In 1920 they were what might be called almost common. First reported on February 1st, small flocks were seen at intervals, and in a variety of locations, until May 21st. They were not reported again until 1929 when five were seen by J. C. Middleton, on March 11th. There were one or two small flocks noted during January, 1930.

(517) EASTERN PURPLE FINCH. *Carpodacus purpureus purpureus*.—This species is also somewhat irregular in its habits, having been found at all seasons of the year. Up until about 1890 they were a frequent summer resident. Of recent years, however, they have been seen only during migrations.

The song is a most pleasing one and a chorus of some 25 spent the latter half of March, 1914, near London, rehearsing, it being our rare privilege to go out on several mornings to listen to them. They were usually found on the flats along the river, near Woodland Cemetery, perched on a tree top where they could catch the first warm rays of the rising sun. The wonderful music from this Purple Finch chorus, after a frosty night, with the air still crisp and clear, will linger long in our memories.

Nests have been found and the eggs taken several times; in fact, a pair nested in Victoria Park, London (in a native balsam), about 1910.

(515) CANADIAN PINE GROSBEEK. *Pinicola enucleator leucura*.—Another rare and rather irregular winter visitor, more frequently reported, though, than the Eastern Evening Grosbeak. It is quite possible they occur every year, but if so they are in such small numbers that they escape notice, as there are sometimes several years in succession when none are recorded. A flock of 32 on December 24th, 1921 (Christmas Census trip), seems to be about the largest on record, although the combined census report of December 28th, 1929, showed a total of 51. During this winter (1929-1930) Middlesex county, in common with other points, was subject to an invasion of Pine Grosbeaks, the birds being very generally reported throughout the district from November till April.

(526.1) BRITISH GOLDFINCH. *Carduelis carduelis britannica*.—"April 8th, 1909; at the south-east corner of Victoria Park, London, I got off my bicycle, about 8 a.m., to see the first Goldfinch of the season, which was calling overhead. Almost immediately it flew into an Austrian pine and on getting a side view I saw it had bright yellow wing patches.

and the next view showed a red forehead and throat. A 'European'! The note curved a little higher up than that of our bird, and when it flew away, as it did in a minute, it gave a toneless flight call, *whē-lē-lē*, not unlike a Redpoll's note." (Notes W. E. Saunders.)

(528) COMMON REDPOLL. *Acanthis linaria linaria*.—Usually noted every winter in greater or lesser numbers. Occasionally very common, as in the winter of 1906-1907; or as in 1916-1917 when they were seen or heard on every trip recorded between December 16th and March 23rd. Flocks numbering 100 or more are sometimes observed, although smaller numbers are the rule.

A nest of this species with two addled eggs was found near Hyde Park, by John A. Morden, on May 29th, 1879. They were identified by comparison with European eggs, but have since been lost.

(528b) GREATER REDPOLL. *Acanthis linaria rostrata*.—Four *rostrata* were taken by A. A. Wood two miles east of Strathroy, on March 5th, 1926. They were in a flock of some forty *linaria* which were feeding in an alfalfa field. Another was taken on March 16th, 1926, near the same place. (See *The Canadian Field-Naturalist*, 41: 92, April, 1927, "Greater Redpoll at Strathroy", by A. A. Wood.)

These are the only records for the county, though they, and possibly other forms, may occur more frequently than we think in flocks of the commoner species. About the only way to determine these subspecies is to collect the specimens and the majority of bird students nowadays reverse the old adage and say, "A bird in the bush is worth two in the hand".

(533) NORTHERN PINE SISKIN. *Spinus pinus pinus*.—Probably the commonest and most regular of the boreal finches. In years when the white cedar (*Thuja occidentalis*) fruits heavily, they are usually to be found in large numbers from October on throughout the winter months. Those that go farther south return early in March, occasionally favouring us with snatches of song.

"The night of March 13th-14th, 1888, was spent in Komoka swamp (of glorious memory), and one reward of the effort was hearing the song of the Pine Siskin at daybreak on the 14th. The song much resembles that of the Goldfinch with a little of the bass tone of the Siskin's call note. It made a pretty little warble which I liked fully as well as that of the other species". (Notes W. E. Saunders.)

(529) EASTERN GOLDFINCH. *Spinus tristis tristis*.—A common

summer resident, breeding rather late. Wandering flocks of dull-plumaged birds may also usually be found at any time during autumn, winter or early spring.

Nesting records: set of four, July 2nd, 1899; set of five, July 28th, 1914.

(521) RED CROSSBILL. *Loxia curvirostra pusilla*.—It is only about every other year that we can count on seeing these birds, usually as winter visitors. Occasionally, however, they stay well on into May and June and favour us with snatches of their song, a pleasing warble somewhat resembling a mixture of Goldfinch and Purple Finch notes. Of rather commoner occurrence than the White-winged species.

A breeding record (of doubtful value) is that of a nest found some two miles east of London on April 29th, 1909. It was in a maple tree and was situated some 45 feet from the ground, being placed against the trunk of the tree. It was composed mainly of bark strips with some grasses and twigs, and was lined with fine bark strips. It contained four eggs, three Crossbill's and one Cowbird's, and incubation had begun. There is, unfortunately, some doubt as to the species, but indications point to its being "American". The set is in the Saunders collection.

There is a record of one shot on July 5th, 1882. It is in the Saunders collection; also an adult female shot on May 15th, 1912. On August 27th, 1908, five flew over at the spruce swamp (three miles west of London) which were thought to be Red Crossbills, as were two others which flew north-east over the same swamp on September 9th, 1908.

(521b) NEWFOUNDLAND CROSSBILL. *Loxia curvirostra percna*.—There are two specimens in the Saunders collection taken at London, on May 24th, 1892. They were shot by F. Deeley, who selected them from the flock on account of their size, other members of the flock being *pusilla*. One of the specimens measures, length 181, wing 94, tail 57, as against length 157, wing 81, tail 44, for a specimen of the Red Crossbill in the same collection.

A correction. (521d) BENDIRE'S CROSSBILL. *Loxia curvirostra bendirei*.—*The Canadian Field-Naturalist*, 38: 119, May, 1924, contains an article "Notes on Crossbills" by E. M. S. Dale, in which is recorded the taking of two specimens of Bendire's Crossbill at London on May 24th, 1892. These have since been examined by James L. Peters, of Cambridge, Mass., who refers them to the Newfoundland Crossbill, *Loxia curvirostra percna*.

(522) WHITE-WINGED CROSSBILL. *Loxia leucoptera*.—Of irregular occurrence in winter, somewhat rarer than the Red Crossbill. In common with that species, usually found in hemlocks. On May 3rd, 1902, two White-wings were shot by F. V. Langford, a few miles from the city of London in evergreen woods. Both were in the mottled plumage and it is presumed they were young which had been bred there.

(587) RED-EYED TOWHEE. *Pipilo erythrophthalmus erythrophthalmus*.—A common summer resident. A. A. Wood reports a few wintering there during the season of 1917-1918. Two also appeared in our Christmas Census report for 1922. It is rather unusual, though, for them to remain over.

Average date of spring arrival (17 years), March 31st. Earliest, March 15th, 1915.

Nesting dates: set of three, July 6th, 1900, incubation just begun; set of three (plus one Cowbird's), June 17th, 1902, incubation begun; set of three, May 15th, 1907, incubated one-fifth; set of one (plus three Cowbird's), May 28th, 1909, incubated one-fourth; set of four, June 3rd, 1916.

(542a) EASTERN SAVANNAH SPARROW. *Passerculus sandwichensis savanna*.—A common summer resident. The nearest we have to winter records are: first, one in an alfalfa field near Strathroy on November 19th, 1927 (there was about a foot of snow on the ground at the time); and second, one seen by W. E. Saunders a week later near London, in a flock of Tree Sparrows.

Average date of spring arrival (17 years), April 5th. Earliest, March 24th, 1921.

Nesting records: set of five, May 19th, 1906, fresh; set of four, May 21st, 1911; set of four, May 15th, 1913, fresh; set of four, May 29th, 1914; set of five, June 8th, 1917.

(546) EASTERN GRASSHOPPER SPARROW. *Ammodramus savannarum australis*.—Occurs regularly every summer. Although it is easy to locate the fields where they live by the singing males, it is difficult to find the nest and eggs.

Average date of spring arrival (17 years), May 10th. Earliest, April 7th, 1921.

There is set of eggs, with nest, in the Saunders collection taken by A. A. Wood one mile south-west of Strathroy, on July 8th, 1929. The female was on the nest, the male singing nearby. The nest was located

in a sweet-clover field after it was mowed but before it was raked, which made it easier to find. This is the only nesting record we have.

(547) EASTERN HENSLOW'S SPARROW. *Passerherbulus henslowi susurrans*.—There are very few records for Middlesex County, but the birds are so very secretive in their habits, and the song is so very insignificant, that they may easily be passed by. The place to look for them is in wet meadows where the grass is allowed to grow undisturbed. One was heard at the "Ponds" by W. E. Saunders, on June 15th, 1920. Another, first noted on May 4th, 1921, at the "Ponds", remained in the same field all summer. Not found again until 1930 when one was noted in the fall, on October 12th, also at the "Ponds".

In 1931, this species was fairly common in the London district. On May 16th, of that year, while motoring through Komoka swamp, our ears were greeted by the now somewhat familiar song of this little bird. We stopped the car and found quite a number of the birds singing from the weedy fields on both sides of the road. Later on in the year when active bird work eased off, allowing more time for general rambles through the countryside, Henslow's Sparrows were reported from four or five other localities in various directions from the city.

(540) EASTERN VESPER SPARROW. *Poocetes gramineus gramineus*.—A common summer resident. We also have two winter records, the first a bird seen near Glanworth, on December 18th, 1914, and the second a bird found between the city of London and Springbank park, on January 3rd, 1915.

Average date of spring arrival (17 years), April 1st. Earliest, March 24th, 1921.

Nesting records: set of four, May 8th, 1902, fresh; set of four, May 15th, 1907; set of four, May 29th, 1907; set of four, May 27th, 1914; set of four, June 22nd, 1915.

(552) EASTERN LARK SPARROW. *Chondestes grammacus grammacus*.—"In June or July, 1878, I found these first, on Hale St., just south of the C.N.R. tracks. Until 1889 there were one or two pairs to be found there each summer, living in the open sandy fields between the pine trees. Seen again in 1891. Then none were observed near London until 1900 when a pair was seen on the road two miles south-west of Komoka. None have been recorded since." (Notes W. E. Saunders.)

"Joe Beck found a pair of small birds, on April 3rd, 1897, which he observed very closely, and his description fitted the Lark Finch." (Diary of Robert Elliott.)

"A single nest found in 1890 a few miles west of the city (London)." (W. E. Saunders in the *Annual Report of the Entomological Society of Ontario*, 1891.)

A male collected by W. E. Saunders, at London, on April 28th, 1885, is in the collection of the National Museum of Canada, Ottawa.

(567) SLATE-COLOURED JUNCO. *Junco hyemalis hyemalis*.—Formerly nested in fair numbers but of recent years has been seldom seen during the nesting season. It is an abundant migrant, in spring and fall, and a good many remain all winter. Although nesting usually on the ground, one nest was found here ten feet above the ground in a thicket of vines against a brick wall, and contained five eggs.

Nesting records: set of five, April 18th, 1873 (above referred to); set of four, May 20th, 1880, fresh; set of three, May 10th, 1884, Bryanston; set of four, June 16th, 1894, Komoka.

(559) EASTERN TREE SPARROW. *Spizella arborea arborea*.—A common winter resident although their numbers are usually materially increased by arrivals from more southerly points towards the latter part of March.

(560) EASTERN CHIPPING SPARROW. *Spizella passerina passerina*.—A common summer resident. We have no winter record for this species, the nearest to it being one seen at St. Thomas, Elgin County, on December 25th, 1912, by E. M. S. Dale.

Average date of spring arrival (17 years), April 14th. Earliest, April 1st, 1910.

Nesting records: set of four, May 23rd, 1901, fresh; set of four, June 2nd, 1905, fresh; set of four, June 6th, 1908, fresh; set of four, May 20th, 1912; set of four, May 24th, 1913.

(561) CLAY-COLOURED SPARROW. *Spizella pallida*.—This is one of the most interesting birds on our whole list. It was first noted, on May 9th, 1894, near Mount Brydges, the bird having been taken by W. E. Saunders, the first record of this species for Ontario. It did not again occur until May 28th, 1922, when one was observed a mile or two east of the spot where the 1894 specimen was secured. In the next two years it was found in the same field, on May 30th, 1923, and May 28th, 1924. Not until the latter year did it occur to us that it was other than a straggler or an individual bird with a peculiar route of migration. Frequent visits to the field, however, disclosed the fact that it remained there throughout the summer of 1924, although we could find no trace of either

mate or nest. It did not return in 1925. For a somewhat fuller account of this species see *The Canadian Field-Naturalist*, 41: 64, March, 1927, "The Clay-coloured Sparrow at London, Ontario", by E. M. S. Dale.

We had another visit from a Clay-coloured Sparrow in 1931. This bird was discovered by W. E. Saunders on June 26th, singing in a bushy field just south of the Vauxall bridge, south-east of the city of London. It only remained for a few days after it was found; long enough, however, for most of the active field members of the Bird Club to pay it a visit.

(563) EASTERN FIELD SPARROW. *Spizella pusilla pusilla*.—Locally distributed but generally common near London.

Average date of spring arrival (17 years), April 10th. Earliest, March 29th, 1918.

Nesting records: set of four, May 19th, 1902, nearly fresh; set of two (plus two Cowbird's), June 19th, 1902; set of five, June 11th, 1908, fresh; set of three (plus one Cowbird's), May 29th, 1912, incubated one-half; set of four, June 3rd, 1916.

(553) HARRIS'S SPARROW. *Zonotrichia querula*.—"Records of this bird in the Great Lakes region are extremely scarce, but I am now definitely able to record it for lower Ontario. On March 18th, 1907, while walking in from the country, I heard, at 8 a.m., what seemed to be the single long-drawn note of the White-throated Sparrow and as the date was very early for this bird, I stopped to investigate. In a company of Juncos and Song Sparrows, in a garden, was one large, dull-coloured sparrow which I suspected of being the author of the note, and which I took at once to be a 'Harris's'. A request to the lady of the house brought forth a point blank refusal to allow me to shoot anything as 'there was nothing but Robins here'. Promising not to shoot I went out to look, and by looking at sufficiently close range and from the right direction, I scared the bird across the road, and, having profited by my experience, I proceeded to shoot first and ask permission afterwards. It proved to be a male in immature plumage, spotted irregularly on the upper breast, the spots giving a hint of the black colouration which was to come." (Notes W. E. Saunders.)

This is the only record for this species. The specimen above referred to is in the Saunders collection.

(554) WHITE-CROWNED SPARROW. *Zonotrichia leucophrys leucophrys*.—A regular and fairly common migrant in spring and fall. We have no winter record for this sparrow although one was taken at Toronto, on December 11th, 1927. It was in a flock of Tree Sparrows.

Average date of spring arrival (16 years), May 9th. Earliest, May 3rd, 1913.

(558) WHITE-THROATED SPARROW. *Zonotrichia albicollis*.—An abundant migrant in spring and fall. Occasionally found in winter, one that stayed in the city (London) during the winter of 1919-1920 being specially worthy of mention. It came to the food shelf of Miss Brown, Kent St., with other birds, and even during the coldest weather, when snow was deep on the ground, it answered readily to a whistled imitation of its call, the song being rendered with almost springtime vigor. Miss Brown states that it continued coming until the middle of May.

The nest and eggs have not been found so far as we are aware, but singing males in cedar swamps during the summer months would seem to indicate that it breeds in limited numbers in suitable localities.

Average date of spring arrival (17 years), April 18th. Earliest, April 5th, 1921.

(585) EASTERN FOX SPARROW. *Passerella iliaca iliaca*.—These handsome sparrows are regular spring and fall migrants, remaining usually a week or so with us. They are none too common, however, although there are certain places they seem to favour and where they are usually to be found.

Average date of spring arrival (17 years), April 1st. Earliest, March 10th, 1921.

We have one interesting winter record for this species, a bird that came to Miss Brown's food shelf, Kent St., London, regularly during the winter of 1919-1920. Miss Brown also had at the same time a White-throated Sparrow and a Junco, quite a remarkable trio considering the location of her home which is in the heart of the city. (See also under White-throated Sparrow).

(583) LINCOLN'S SPARROW. *Melospiza lincolni lincolni*.—One of the rarer sparrows with us, probably the rarest of the regular migrants. Sometimes a couple of years will slip by without one being observed. This may, perhaps, be due to the fact that they do not always sing, and to the impossibility of scrutinizing every sparrow with the glass during the middle of May, the time when they pass through.

Average date of spring arrival (8 years), May 14th. Earliest, May 8th, 1924.

One was observed in the junior writer's garden, in the heart of the city (London), on May 14th, 1918, where it remained all day. In the fall one was also observed in the same garden on October 7th, an inter-

esting occurrence in view of what we are now learning through bird-banding. If birds go from the same winter home to the same summer home each year, what is more reasonable than to suppose that they follow the same route?

(584) SWAMP SPARROW. *Melospiza georgiana*.—A common summer resident wherever it finds a spot to its liking. We have no winter record for this species.

Average date of spring arrival (17 years), April 8th. Earliest, March 21st, 1918.

Nesting records: set of four, May 27th, 1898; set of three, June 2nd, 1907, incubated two-thirds; set of five, May 16th, 1908.

(581) EASTERN SONG SPARROW. *Melospiza melodia melodia*.—A very abundant summer resident. A few remain each winter, making it difficult to tell just when the spring birds arrive, but by March 10th we hear them singing in various places and usually conclude that they are newcomers.

Nesting records: set of four (plus two Cowbird's), June 1st, 1892, fairly fresh; set of three, August 1st, 1901, incubated three days; set of five, June 18th, 1904, incubated one-third; set of four (plus one Cowbird's), May 12th, 1906, fresh; set of five, May 17th, 1907, incubated one-quarter; set of four (plus two Cowbird's), May 6th, 1916.

(536) LAPLAND LONGSPUR. *Calcarius lapponicus lapponicus*.—Not at all common, though they may occur more often than we think, mixed up in flocks of Snow Buntings or Larks.

The first record seems to be March 23rd, 1883, one in a flock of Larks at Pottersburg. The specimen was taken and is now in the Saunders collection. Robert Elliott, of Bryanston, first found them on April 3rd, 1890. He noted them on different occasions after that date, once killing one by throwing a stone at it. Eight were observed by W. E. Saunders at Komoka, on March 10th, 1911. Another Middlesex specimen in the Saunders collection was taken on November 16th, 1901. Two were seen in a flock of Larks just north of London, on February 9th, 1913, by J. F. Calvert and E. M. S. Dale. A. A. Wood found them at Strathroy in November, 1926, as recorded in *The Canadian Field-Naturalist*, 41: 62, March, 1927, "Some Rare Birds at Strathroy, Ontario", by A. A. Wood. He also saw some the following year (November, 1927), and again several times in January, 1928. Since then they have been noted every year, either in the late fall or early spring, or both. It remained, however, for Tom Willis, Jr., of London, to make the most interesting record in con-

nection with this species. On May 4th, 1929, while on a walk to White Oak he found a flock of about 100 in a field by the road. They were very tame and allowed him to approach within a few feet of them so that there can be no doubt of the identity. Several trips to the vicinity were made by other members of the McIlwraith Ornithological Club during the succeeding few days, and although we failed to get as close a view of the birds as did the discoverer, flocks numbering from a few individuals to one containing "hundreds", were seen to pass overhead, all flying from east to west.

(534) EASTERN SNOW BUNTING. *Plectrophenax nivalis nivalis*.—A common winter resident usually occurring in flocks, which sometimes number a thousand or more. One of the prettiest winter sights is to see a flock of these birds, feeding in a weedy field, suddenly take alarm, and rising, falling, twisting, turning, fly around one's head as if guided by a single impulse, all the while twittering merrily away.

Total, 267 species, together with five hypothetical and four corrections.

ADDENDA

Since this paper was prepared and sent to the publishers, a number of interesting records have been made which it has been thought desirable to add, although as stated at the beginning it was the intention to list only those up to the 31st of December, 1931. Two of these records, the White Gyrfalcon (*Falco rusticolus candicans*) and the Blue-winged Warbler (*Vermivora pinus*), are new birds for the county list, while the other species mentioned is of very unusual occurrence; otherwise this account would not be further prolonged by including them. The two new records bring the total up to 267, and it is particularly interesting to note that one of them, the Blue-winged Warbler, is a species which we intimated might be looked for in Middlesex County as it had been taken nearby. We hardly expected our prophecy to be fulfilled so soon.

(169.1) BLUE GOOSE. *Chen caerulescens*.

On March 25th, 1932, the two authors, together with Eli Davis, saw a bird standing on the ice on the south side of the river (Thames) just east of Byron bridge, which we were unable to identify. It was quite evident that it was a goose but the plumage was not that of any species with which we were familiar, and we thought it must be a foreign one that had escaped from one of the pens at Springbank Park close by. We noted all the markings at fairly close range, and then, as the bird seemed

quite unafraid, we went along the bank until we were above it. This, however, was more than it would tolerate, so it started to walk away, breaking through the ice after a step or two. It then essayed to swim, but found that the ice, which would not bear its weight for walking, was, nevertheless, too thick for swimming, so the only thing left was to take to its wings, which it did promptly. We decided then that it must be a wild bird after all, but although many of the markings agreed perfectly with those of the Blue Goose, which we suspected it to be, there were still a few points on which we could not satisfy ourselves. It was not until October 20th of the same year, while attending the sessions of the A.O.U. at Quebec, that we had an opportunity of examining a number of specimens in various plumages in the collection of Dr. Gustave Langelier, at Cap Rouge. We found there sufficient additional evidence to clear up the points in question and have now put it on record as an immature Blue Goose, the second occurrence in the county.

(353) WHITE GYRFALCON. *Falco rusticolus candicans*.

Sight records of very rare birds are always open to question but a sufficient number go a long way to establishing each other. In December, 1889, near Appin, 25 miles west of London, the senior author saw a large white bird, evidently a falcon, flying west at a great height. As this was the only one seen in the county it was to have been omitted from this record, but on January 9th, 1932, five miles west of London, a white bird, much larger than a pigeon, flying with slow wing strokes which carried it enormous distances at great speed against a strong wind, could hardly have been anything but a Gyrfalcon. It was much larger than a pigeon, the wing strokes much slower, and the speed much greater, and it was watched until it flew out of sight half a mile west, where it would have passed over the river.

(641) BLUE-WINGED WARBLER. *Vermivora pinus*.

"On the morning of May 16th, 1932, while checking up on the spring migration near Strathroy, a new warbler note was heard. This is a rare pleasure in the locality as the warblers have been studied quite thoroughly. The song in tone and volume resembled the Golden-winged warbler, but the notes were quite different. It sounded something like this:

ze
ze-ze-ze ze
za za

sung once in the buzzing voice of the Golden-wing. Nearly an hour was

spent in locating the singer which proved to be a beautiful male Blue-winged Warbler. The specimen is No. 4093 in my collection.

The location was just a few hundred yards from where the Kentucky Warbler was collected in 1931, but down on the low ground in the valley of the Sydenham River. The swamp was densely wooded with cedar, tamarack, black birch, aspen and many small shrubs." (Notes A. A. Wood.)

FLOWERING PLANTS AND FERNS OF PRINCE EDWARD ISLAND

By BLYTHE HURST, SENIOR

FOREWORD

It is over forty years since the Natural History Society of Prince Edward Island published "A List of Prince Edward Island Plants" by Francis Bain, and almost a quarter of a century since a more complete list by John MacSwain appeared as a supplement to Spotton's Botany. A great many additional plants have been found in this province within the last two decades, and the present compilation includes them; it, however, makes no pretence to completeness, since there is reason to suspect that further "finds" will reward the diligent searcher.

The scientific names of the plants are mostly in accordance with those given in Gray's New Manual of Botany (seventh edition) entitled "A Handbook of the Flowering Plants and Ferns of the Central and Northeastern United States and Adjacent Canada", published in 1908.

The compiler of this list gratefully acknowledges his obligation to Mr. H. Groh, Botanist, Ottawa, who visited the island in 1926, Mr. R. R. Hurst, Plant Pathologist at the Experimental Station, Charlottetown, and Mr. Harold Messervy, City Engineer, for their valued contributions. In further acknowledgment their names are appended to all plants to which they have called attention as being absent from the above mentioned lists.

Plants discovered by the present author are distinguished by the designation "B. Hurst", while in a few cases "Bain" is cited as the discoverer. The names of about 30 species¹ not mentioned in previous lists have been taken from John Macoun's "Catalogue of Canadian Plants". These are indicated by his name in brackets. In other cases where there is no distinguishing mark the name of the species is taken from MacSwain's list.

The number of species (414) in MacSwain's list has now been increased to a total of 594 species and varieties. Plants which are not really indigenous but have been introduced mainly through cultivation are marked by an asterisk (*). These account for 151 species, mostly weeds, out of the total Flora.

¹These have been incorporated by Mr. J. Adams, Botanist, Ottawa, who kindly consented to see this publication through the press.

Some species of doubtful occurrence whose range does not appear to extend so far north, or species whose identification requires confirmation, are included in a list at the end.

PTERIDOPHYTA

POLYPODIACEAE

- Polypodium vulgare* L.—Common Polypody.
Phegopteris polypodioides Fee—Beech Fern.
Dryopteris (L.) Fee—Oak Fern.
Pteris aquilina L.—Common Brake or Bracken.
Woodwardia virginica (L.) Sm.—Chain Fern.
Asplenium acrostichoides Sw.—Angle-fruited Lady Fern.
Filix-femina (L.) Bernh.—Common Lady Fern.
Polystichum acrostichoides (Michx.) Schott.—Christmas Fern.
Aspidium Thelypteris (L.) Sw.—Marsh Shield Fern.
noveboracense (L.) Sw.—New York Shield Fern.
Boottii Tuckerm.—Wood Shield Fern.
cristatum (L.) Sw.—Crested Shield Fern.
marginale (L.) Swartz.—Evergreen Wood-fern. (J. Macoun)
Onoclea sensibilis L.—Sensitive Fern.
Struthiopteris (L.) Hoffm.—Ostrich Fern.
Dicksonia punctilobula (Michx.) Gray—Hay-scented Fern.
(J. Macoun).

OSMUNDACEAE

- Osmunda regalis* L.—Flowering or Royal Fern.
Claytoniana L.—Clayton's Fern.
cinnamomea L.—Cinnamon Fern.

OPHIOGLOSSACEAE

- Ophioglossum vulgatum* L.—Adder's Tongue. (J. Macoun).
Botrychium ternatum (Thunb.) Sw.—Leathery Moonwort.
virginianum (L.) Sw.—Virginia Moonwort.
ramosum (Roth) Aschers.—Chamomile-leaved Grape-fern.
(J. Macoun).
simplex E. Hitchc.—Little Grape-fern. (J. Macoun).

EQUISETACEAE

- Equisetum arvense* L.—Common Horsetail. (Groh).
sylvaticum L.—Wood Horsetail. (Groh).

- palustre* L.—Marsh Horsetail. (Groh).
hyemale L.—Scouring Rush. (Groh).
fluviatile L.—Swamp Horsetail. (J. Macoun).
scirpoides Michx.—Sedge-like Horsetail. (J. Macoun).

LYCOPODIACEAE

- Lycopodium clavatum* L.—Common Club-moss. (B. Hurst).
clavatum L. var. *monostachyon* Hook.—Single-spiked Club-moss.
 (J. Macoun).
complanatum L. var. *flabelliforme* Fernald—Ground Pine.
 (B. Hurst).
lucidulum Michx.—Shining Club-moss. (J. Macoun).
inundatum L.—Marsh Club-moss. (J. Macoun).
obscurum L.—Tree Club-moss. (J. Macoun).
annotinum L.—Stiff Club-moss. (J. Macoun).
sabinaefolium Willd.—Cedar-like Club-moss. (J. Macoun).

GYMNOSPERMAE

TAXACEAE

- Taxus canadensis* Marsh.—American Yew.

PINACEAE

- Pinus Strobus* L.—White Pine.
resinosa Ait.—Red Pine.
Larix laricina (Du Roi) Koch.—American Larch, locally "Juniper".
Picea canadensis (Mill.) BSP.—White Spruce.
mariana (Mill.) BSP.—Black Spruce.
rubra (Du Roi) Dietr.—Red Spruce. (J. Macoun).
Abies balsamea (L.) Mill.—Balsam Fir.
Tsuga canadensis (L.) Carr.—Hemlock.
Thuja occidentalis L.—White Cedar or Arbor Vitae.
Juniperus communis L. var. *montana* Ait.—Alpine Juniper. (Messervy).
horizontalis Moench.—Savin.

ANGIOSPERMAE

MONOCOTYLEDONES

TYPHACEAE

- Typha latifolia* L.—Common Cat-tail, locally Bulrush.

SPARGANIACEAE

- Sparganium eurycarpum* Engelm.—Broad-fruited Bur-reed.
simplex Huds.—Simple-stemmed Bur-reed.
americanum Nutt.—American Bur-reed. (R. R. Hurst).
diversifolium Graebner var. *acaule* Fernald and Eames.—Stemless
 Bur-reed. (J. Macoun).

POTAMOGETONACEAE

- Potamogeton natans* L.—Common Pondweed.
praelongus Wulf.—White-stemmed Pondweed.
pectinatus L.—Fennel-leaved Pondweed.
Friesii Rupr.—Fries' Pondweed. (J. Macoun).
flabellatus Bab.—Interrupted Pondweed. (J. Macoun).
Zostera maritima L.—Seaside Arrow-grass.

JUNCAGINACEAE

- Zostera marina* L.—Eel-grass, locally "Seaweed". (B. Hurst).

ALISMACEAE

- Sagittaria latifolia* Willd.—Broad-leaved Arrow-head.
Alisma Plantago-aquatica L.—Water Plantain.

GRAMINEAE

The Gramineae, or grasses, have received little attention from local botanists, owing perhaps to the difficulty of determining them without specimens for comparison. The following list is compiled from Groh's "Survey" in 1926, and from Bain's list in his "Natural History of P.E.I.". Many other species remain unlisted.

- Digitaria *humifusa* Pers.—Small Crab Grass. (B. Hurst).
*Echinochloa *crus-galli* (L.) Beauv.—Barnyard Grass. (Groh).
*Setaria *glaucæ* (L.) Beauv.—Foxtail or Pigeon Grass. (Groh).
**viridis* (L.) Beauv.—Green Foxtail. (Groh).
*Phalaris *canariensis* L.—Canary Grass. (Bain).
arundinacea L. var. *picta* L.—Ribbon Grass. (Groh).
*Anthoxanthum *odoratum* L.—Sweet Vernal Grass. (Groh).
Hierochloë odorata (L.) Wahlenb.—Vanilla Grass. (Groh).
*Phleum *pratense* L.—Timothy. (Groh).
Agrostis alba L.—Red Top or Fiorin Grass. (Groh).
hyemalis (Walt.) BSP.—Hair Grass. (Groh).
**canina* L.—Brown Bent Grass. (Groh).

- Calamagrostis canadensis* (Michx.) Beauv.—Blue Joint Grass. (Groh).
Ammophila arenaria (L.) Link.—Beach Grass or Marram. (Bain).
Danthonia spicata (L.) Beauv.—Wild Oat Grass. (Groh).
Spartina patens (Ait.) Muhl.—Marsh Grass. (Bain).
*Dactylis *glomerata* L.—Orchard Grass. (Groh).
*Poa *annua* L.—Low Spear Grass. (Groh).
 **compressa* L.—Canada Blue Grass. (Groh).
 triflora Gilib.—False Red Top. (Groh).
 pratensis L.—June Grass. (Groh).
Glyceria nervata (Willd.) Trin.—Fowl Meadow Grass. (Bain).
Festuca rubra L.—Red Fescue. (Groh).
 ovina L.—Sheep's Fescue. (Groh).
 **elatior* L.—Meadow or Tall Fescue. (Bain).
Agropyron repens (L.) Beauv.—Couch Grass. (Groh).
Hordeum jubatum L.—Wild Barley, Squirrel-tail. (Groh).

CYPERACEAE

Like the grasses, this extensive family is a difficult one, hence little has been done locally in the way of determinations.

- Scirpus americanus* Pers.—Three-square, Chair-maker's Rush.
 (B. Hurst).
Eriophorum callitrix Cham.—Hare's-tail Cotton-grass. (B. Hurst).
 angustifolium Roth—Fall Cotton-grass. (B. Hurst).
Heleocharis palustris L.—Creeping Spike-rush. (J. Macoun).
Carex Crawfordii Fernald.—Crawford's Sedge. (R. R. Hurst).
 Pseudo-Cyperus L.—Cyperus-like Sedge. (B. Hurst).
 Novae-Angliae Schw.—New England Sedge. (J. Macoun).
 deflexa Horneman var. *Deanii* Bailey—Northern Sedge.
 (J. Macoun).

ARACEAE

- Arisaema triphyllum* (L.) Schott.—Indian Turnip.
Calla palustris L.—Water Arum, Marsh Calla.
Acorus Calamus L.—Sweet Flag, Calamus.

LEMNACEAE

- Lemna minor* L.—Lesser Duckweed.

PONTEDERIACEAE

- Pontederia cordata* L.—Pickerel Weed. (Messervy).

JUNCACEAE

- Juncus bufonius* L.—Toad Rush. (Groh).
tenuis Willd.—Slender Rush.
balticus Willd.—Baltic Rush. (R. R. Hurst).
effusus L.—Common or Soft Rush.
Luzula campestris (L.) D.C. var. *multiflora* (Ehrh.) Celak.—Wood-Rush. (Groh).
spicata (L.) D.C.—Spiked Wood-rush.

LILIACEAE

- Asparagus *officinalis* L.—Asparagus. (Groh).
Clintonia borealis Raf.—Yellow Clintonia.
Smilacina racemosa (L.) Desf.—False Spikenard.
stellata (L.) Desf.—Star-flowered Solomon's Seal.
trifolia (L.) Desf.—Three-leaved Solomon's Seal.
Maianthemum canadense Desf.—False Lily-of-the-Valley.
Streptopus amplexifolius (L.) D.C.—Clasping-leaved Twisted-stalk. (Messervy).
roseus Michx.—Rosy Twisted-stalk.
Medeola virginiana L.—Indian Cucumber-root.
Trillium erectum L.—Fetid Wake-robin.
cernuum L.—Nodding Wake-robin.
undulatum Willd.—Painted Wake-robin.

IRIDACEAE

- Iris versicolor* L.—Larger Blue Flag.
Sisyrinchium angustifolium Mill.—Blue-eyed Grass.

ORCHIDACEAE

- Cypripedium hirsutum* Mill.—Showy Lady's Slipper.
acaule Ait.—Stemless Lady's Slipper.
Habenaria dilatata (Pursh) Gray.—Tall White Bog Orchis. (Messervy).
clavellata (Michx.) Spreng.—Three-toothed Rein Orchis.
orbiculata (Pursh) Torr.—Round-leaved Orchis.
blephariglottis (Willd.) Torr.—White-fringed Orchis.
lacera (Michx.) R.Br.—Ragged Fringed Orchis. (B. Hurst).
psycodes (L.) Sw.—Purple Fringed Orchis. (Messervy).
Andrewsii White.—Andrew's Orchis. Messervy).
fimbriata (Ait.) R.Br.—Large-flowered Orchis. (Bain).
Pogonia ophioglossoides (L.) Kerr.—Rose Pogonia, Snake's Mouth.

- Calopogon pulchellus* (Sw.) R.Br.—Grass-pink.
Arethusa bulbosa L.—Arethusa. (Messervy).
Spiranthes gracilis (Bigel.) Beck.—Slender Ladies' Tresses.
 Romanzoffiana Cham.—Hooded Ladies' Tresses.
Epipactis repens (L.) Crantz.—Rattlesnake Plantain.
Corallorrhiza maculata Raf.—Large Coral-root.
 trifida Chatelain.—Early Coral-root. (Messervy).
 odontorrhiza Nutt.—Smaller Coral-root.
Microstylis unifolia (Michx.) BSP.—Adder's Mouth. (B. Hurst).
Liparis Loeselii (L.) Richard.—Twayblade.

DICOTYLEDONES

SALICACEAE

- Salix* **fragilis* L.—Crack Willow. (B. Hurst).
 **alba* L.—White Willow. (B. Hurst).
 discolor Muhl.—Glaucous Willow.
 humilis Marsh.—Prairie Willow.
 **purpurea* L.—Purple Willow. (Groh).
Populus **alba* L.—White Poplar, Abele. (B. Hurst).
 tremuloides Michx.—American Aspen.
 grandidentata Michx.—Large-toothed Aspen.
 balsamifera L.—Balsam Poplar.
 **nigra italica* Du Roi.—Lombardy Poplar. (B. Hurst).

MYRICACEAE

- Myrica Gale* L.—Sweet Gale, Bog Myrtle.
 carolinensis Mill.—Bayberry. (Given as *Myrica cerifera* by Mac-Swain).
 asplenifolia L.—Sweet Fern.

BETULACEAE

- Corylus rostrata* Ait.—Beaked Hazelnut.
Betula lutea Michx. f.—Yellow Birch.
 populifolia Marsh.—White Birch.
 alba L. var. *papyrifera* (Marsh.) Spach.—Paper or Canoe Birch.
Alnus crispa (Ait.) Pursh.—Green or Mountain Alder.
 incana (L.) Moench.—Speckled or Hoary Alder.

FAGACEAE

- Fagus grandifolia* Ehrh.—American Beech.
Quercus **alba* L.—White Oak. (B. Hurst).
 rubra L.—Red Oak.

ULMACEAE

Ulmus americana L.—White Elm.

CANNABACEAE

Humulus Lupulus L.—Common Hop.

URTICACEAE

Urtica gracilis Ait.—Slender Nettle.

**urens* L.—Small Nettle.

SANTALACEAE

Comandra umbellata (L.) Nutt.—Bastard Toadflax. (Messervy).

LORANTHACEAE

Arceuthobium pusillum Peck.—Dwarf Mistletoe. (Groh).

(A dwarf parasite, sometimes causing "Witches' brooms" on Spruce and Larch.)

POLYGONACEAE

Rumex Britannica L.—Great Water Dock. (R. R. Hurst).

**crispus* L.—Curled or Yellow Dock.

**elongatus* Guss.—Long-grained Dock. (B. Hurst).

**obtusifolius* L.—Bitter Dock.

**Acetosella* L.—Sheep Sorrel.

Polygonum aviculare L.—Knotgrass, Goosegrass.

erectum L.—Erect Knotweed. (Groh).

lapathifolium L.—Dock-leaved, or Pale Persicaria.

amphibium L.—Water Persicaria.

Hydropiper L.—Smartweed, Water Pepper.

acre L.—Water Smartweed.

**Persicaria* L.—Lady's Thumb.

virginianum L.—Virginia Knotweed.

arifolium L.—Halbert-leaved Tear-thumb.

sagittatum L.—Arrow-leaved Tear-thumb.

**Convolvulus* L.—Black Bindweed.

cilinode Michx.—Fringed Black Bindweed. (Messervy).

Rayi Bab.—Ray's Knotweed. (J. K. Small).

*Fagopyrum *esculentum* Moench.—Buckwheat.

CHENOPODIACEAE

- Chenopodium* **Bonus-Henricus* L.—Good King Henry. (Groh).
rubrum L.—Coast Blite.
 **glaucum* L.—Oak-leaved Goosefoot. (Groh).
 **album* L.—Lamb's Quarters.
 **urbicum* L.—Upright Goosefoot.
Atriplex patula L. var. *littoralis* Gray.—Spreading Orache.
patula L. var. *hastata* (L.) Gray.—Halbert-leaved Orache.
 (B. Hurst).
Salicornia europaea L.—Marsh Samphire.
Salsola Kali L.—Saltwort.

AMARANTACEAE

- Amarantus* **retroflexus* L.—Pigweed.
Acnida tuberculata Moq., var. *subnuda* Watson.—Water Hemp.

ILLECEBRACEAE

- Scleranthus* **annuus* L.—Knewel.

CARYOPHYLLACEAE

- Spergularia rubra* (L.) J. et C. Presl.—Sand Spurrey.
marina (L.) Griseb.—Salt-marsh Sand Spurrey. (J. Macoun).
canadensis (Pers.) Don.—Northern Sand Spurrey. (J. Macoun).
Spergula **arvensis* L.—Corn Spurrey.
Sagina procumbens L.—Pearlwort.
nodosa (L.) Fenzl.—Knotted Pearlwort.
Arenaria **serpyllifolia* L.—Thyme-leaved Sandwort.
lateriflora L.—Blunt-leaved Sandwort.
peploides L.—Beach Sandwort.
Stellaria **media* (L.) Cyrill.—Common Chickweed.
longifolia Muhl.—Long-leaved Stitchwort.
longipes Goldie.—Long-stalked Stitchwort.
 **graminea* L.—Lesser Stitchwort.
Cerastium arvense L.—Field Mouse-ear Chickweed.
 **vulgatum* L.—Larger Mouse-ear Chickweed.
 **viscosum* L.—Common Mouse-ear Chickweed.
Agrostemma **Githago* L.—Corn Cockle.
Lychnis **alba* Mill.—White Champion. (Groh).
Silene noctiflora L.—Night-flowering Catchfly. (Groh).
latifolia (Mill.) Britton et Rendle.—Bladder Champion.
Saponaria **officinalis* L.—Soapwort, Bouncing Bet. (Messervy).

PORTULACACEAE

Claytonia caroliniana Michx.—Spring Beauty.

NYMPHAEACEAE

Nymphaea advena Ait.—Yellow Pond-lily.

Castalia odorata (Ait.) Woodville & Wood.—Sweet-scented Water Lily.
(Messervy).

RANUNCULACEAE

Ranunculus aquatilis L. var. *capillaceus* DC.—Common White Water
Crowfoot.

Cymbalaria Pursh.—Seaside Crowfoot.

delphinifolius Torr.—Yellow Water Crowfoot.

abortivus L.—Small-flowered Crowfoot.

sceleratus L.—Cursed Crowfoot.

Purshii Richards.—Pursh's Buttercup. (J. Macoun).

septentrionalis Poir.—Swamp Buttercup. (J. Macoun).

repens L.—Creeping Buttercup.

**bulbosus* L.—Bulbous Buttercup.

**acris* L.—Tall Buttercup or Crowfoot.

Thalictrum polygamum Muhl.—Tall Meadow Rue.

(The *Thalictrum pubescens* of Bain may be the variety *hebecarpum*
Fernald.)

Caltha palustris L.—Marsh Marigold.

Coptis trifolia (L.) Salisb.—Three-leaved Goldthread.

Actaea rubra (Ait.) Willd.—Red Baneberry.

alba (L.) Mill.—White Baneberry.

BERBERIDACEAE

Berberis vulgaris L.—Common Barberry. (Groh).

FUMARIACEAE

Dicentra Cucullaria (L.) Bernh.—Dutchman's Breeches.

Corydalis sempervirens (L.) Pers.—Pale Corydalis.

CRUCIFERAE

Thlaspi arvense L.—Field Penny Cress. (Groh).

Lepidium virginicum L.—Wild Peppergrass.

**apetalum* Willd.—Apetalous Peppergrass. (Groh).

- *sativum* L.—Garden Cress. (Groh).
**campestre* (L.) R.Br.—Field or Cow Cress. (Groh).
*Capsella *Bursa-pastoris* (L.) Medic.—Shepherd's Purse.
*Camelina *microcarpa* Andrz.—Small-fruited False Flax. (B. Hurst).
Cakile edentula (Bigel.) Hook.—Sea Rocket.
Raphanus Raphanistrum L.—Jointed Charlock, Wild Radish. (Groh).
*Brassica *arvensis* (L.) Ktze.—Charlock. (Groh).
**juncea* (L.) Cosson.—Indian Mustard. (Groh).
**nigra* (L.) Koch.—Black Mustard.
**campestris* L.—Wild Navew, Wild Turnip. (Groh).
*Sisymbrium *officinale* (L.) Scop.—Hedge Mustard. (Groh).
**altissimum* L.—Tumble Mustard. (Groh).
**Sophia* L.—Flizweed. (Groh).
Erysimum cheiranthoides L.—Worm-seed Mustard. (Groh).
*Radicula *Nasturtium-aquaticum* (L.) Britton et Rendle.—Water-cress. (Groh).
palustris (L.) Moench.—Marsh-cress. (Groh).
**Armoracia* (L.) Robinson.—Horseradish.
Barbarea vulgaris R.Br.—Common Winter Cress. (B. Hurst).
stricta Andrz.—Erect-fruited Winter Cress. (Groh).
Cardamine hirsuta L.—Hairy Bitter Cress.
pennsylvanica Muhl.—Pennsylvania Bitter Cress. (Groh).

SARRACENIACEAE

- Sarracenia purpurea* L.—Pitcher Plant.

DROSERACEAE

- Drosera rotundifolia* L.—Round-leaved Sundew.

CRASSULACEAE

- Tillaea aquatica* L.—Water Pigmy-weed.
Sedum purpureum Tausch.—Garden Orpine, Live-for-ever.

SAXIFRAGACEAE

- Mitella nuda* L.—Naked-stalked Mitre-wort.
Chrysosplenium americanum Schwein.—Golden Saxifrage.
Parnassia palustris L.—Grass of Parnassus.
Ribes oxycanthoides L.—Smooth Gooseberry.
floridum L'Her.—Wild Black Currant.
lacustre (Pers.) Poir.—Swamp Black Currant. (B. Hurst).
prostratum L'Her.—Skunk Currant. (B. Hurst).
triste Pall.—Swamp Red Currant.

ROSACEAE

- Spiraea latifolia* Borkh.—Meadow-sweet. (Groh).
tomentosa L.—Hardhack. (Groh).
Pyrus **Malus* L.—Apple. (B. Hurst).
arbutifolia (L.) L. f.—Chokeberry.
melanocarpa Willd.—Black-berried Chokeberry. (Bain).
americana (Marsh.) DC.—Mountain Ash.
sitchensis (Roem.) Piper.—Large-fruited Mountain Ash.
 (B. Hurst).
Amelanchier canadensis (L.) Medic.—Juneberry.
Botryapium (L.f.) T. et G.—Downy Juneberry. (Bain).
oblongifolia (T. et G.) Roem.—Wide-leaved Juneberry.
 (*Amelanchier alnifolia* Nutt. listed by MacSwain, is a western plant).
Crataegus **Oxyacantha* L.—English Hawthorn.
Fragaria virginiana Duchesne.—Scarlet Strawberry.
Potentilla monspeliensis L.—Rough Cinquefoil. (Groh).
norvegica (L.) Rydb.—Norway Cinquefoil.
argentea L.—Silvery Cinquefoil.
palustris (L.) Scop.—Marsh or Purple Cinquefoil. (Messervy).
fruticosa L.—Shrubby Cinquefoil.
tridentata Ait.—Three-toothed Cinquefoil.
Anserina L.—Silver-weed.
canadensis L.—Five Finger. (Groh).
Filipendula **Ulmaria* (L.) Maxim.—Queen of the Meadow.
 (B. Hurst).
Geum macrophyllum Willd.—Large-leaved Avens.
strictum Ait.—Yellow Avens.
Rubus idaeus L. var. *aculeatissimus* (C. A. Mey) Regel. et Tiling.—
 Red Wild Raspberry.
occidentalis L.—Black Raspberry. (Bain).
Chamaemorus L.—Cloudberry, Bake-apple. (Messervy).
triflorus Richards.—Dwarf Raspberry.
frondosus Bigel.—Leafy-bracted Blackberry. (Bain).
canadensis L.—Low Blackberry.
hispidus L.—Running Swamp Blackberry.
trivialis Michx.—Southern Dewberry. (Bain).
Agrimonia gryposepala Wallr.—Tall Hairy Agrimony. (Groh).
striata Michx.—Woodland Agrimony. (Groh).
Rosa blanda Ait.—Early Wild Rose.
 **rubiginosa* L.—Sweetbrier.
carolina L.—Swamp Rose.
virginiana Mill.—Glossy Rose.

- Prunus serotina* Ehrh.—Wild Black Cherry.
virginiana L.—Choke Cherry.
pennsylvanica L. f.—Wild Red Cherry.

LEGUMINOSAE

- Trifolium *arvense* L.—Rabbit-foot or Stone Clover.
**pratense* L.—Red Clover.
**medium* L.—Zigzag Clover.
repens L.—White Clover.
**hybridum* L.—Alsike (Alsatian) Clover.
**agrarium* L.—Yellow or Hop Clover.
**procumbens* L.—Low Hop Clover.
*Melilotus *alba* Desr.—White Melilot, Sweet Clover.
**lupulina* L.—Black Medick.
*Robinia *Pseudo-Acacia* L.—Common Locust.
**viscosa* Vent.—Clammy Locust.
*Vicia *sativa* L.—Spring or Common Vetch.
**angustifolia* (L.) Reichard.—Small Common Vetch. (Groh).
**sepium* L.—Bush Vetch. (Groh).
**tetrasperma* (L.) Moench.—Slender Vetch. (Groh).
**hirsuta* (L.) S. F. Gray.—Hairy-pod Vetch.
Cracca L.—Tufted or Blue Vetch.
Lathyrus maritimus (L.) Bigel.—Beach Pea.
palustris L.—March Vetchling.
**pratensis* L.—Meadow Pea.

LINACEAE

- Linum *usitatissimum* L.—Common Flax. (Groh).

OXALIDACEAE

- Oxalis Acetosella* L.—Common Wood Sorrel.
corniculata L. var. *stricta* Sav.—Yellow Wood Sorrel.

GERANIACEAE

- Geranium *pratense* L.—Meadow Cranesbill. (Groh).

EUPHORBIACEAE

- Euphorbia polygonifolia* L.—Seaside Spurge.
**Helioscopia* L.—Sun Spurge, Wartweed.
**Cyparissias* L.—Cypress Spurge.
**Peplus* L.—Petty Spurge.

EMPETRACEAE

Empetrum nigrum L.—Black Crowberry.

ANACARDIACEAE

Rhus hirta Sudw.—Staghorn Sumach.

glabra L.—Smooth Sumach.

Toxicodendron L.—Poison Ivy. (Bain).

AQUIFOLIACEAE

Ilex verticillata (L.) Gray.—Black Alder, Winterberry.

Nemopanthis mucronata (L.) Trel.—Mountain Holly.

ACERACEAE

Acer pennsylvanicum L.—Striped Maple, Moosewood.

spicatum Lam.—Mountain Maple.

saccharum Marsh.—Sugar or Rock Maple.

saccharinum L.—White or Silver Maple.

Negundo L.—Box Elder, Manitoba Maple.

BALSAMINACEAE

Impatiens pallida Nutt.—Pale Jewelweed.

biflora Walt.—Spotted Jewelweed.

**parviflora* DC.—Small-flowered Jewelweed. (Groh). (Found near
Charlottetown: an introduction.)

RHAMNACEAE

Rhamnus cathartica L.—Common Buckthorn. (Groh).

MALVACEAE

Malva moschata L.—Musk Mallow.

HYPERICACEAE

Hypericum perforatum L.—Common St. John's Wort.

mutilum L.—Dwarf St. John's Wort.

canadense L.—Canadian St. John's Wort.

virginicum L.—Marsh St. John's Wort.

CISTACEAE

Hudsonia tomentosa Nutt.—Downy Hudsonia.

Lechea intermedia Leggett.—Large-podded Pinweed. (Groh).

VIOLACEAE

- Viola blanda* Willd.—Sweet White Violet.
palmata L. var. *cucullata* Gray.—Early Blue Violet.
Selkirkii Pursh.—Selkirk's Violet.
pubescens Ait.—Downy Yellow Violet.
labradorica Schr.—American Dog Violet.
**tricolor* L.—Heartsease or Pansy.
**arvensis* Murr.—Field Pansy. (B. Hurst).

THYMELAEACEAE

- Daphne*, **Mezereum* L.—Mezereon. (Messervy).

ONAGRACEAE

- Epilobium angustifolium* L.—Great Willow-herb, Fireweed.
densum Raf.—Linear-leaved Willow-herb. (Messervy).
coloratum Muhl.—Purple-leaved Willow-herb.
palustre L.—Marsh Willow-herb.
adenocaulon Haussk.—Northern Willow-herb. (B. Hurst).
Oenothera muricata L.—Muricate Evening Primrose. (Groh).
biennis L.—Common Evening Primrose.
pumila L.—Small Evening Primrose, Sundrops.
cruciata Nutt.—Cruciate Evening Primrose. (B. Hurst). (First record in Herbarium, Ottawa, 1928.)
Circaea alpina L.—Enchanter's Nightshade.

HALORRHAGACEAE

- Myriophyllum spicatum* L.—Water Milfoil.
Hippuris vulgaris L.—Mare's tail.

CALLITRICHACEAE

- Callitriche palustris* L.—Water Starwort.

ARALIACEAE

- Aralia racemosa* L.—Spikenard.
hispida Vent.—Bristly Sarsaparilla.
nudicaulis L.—Wild Sarsaparilla.

UMBELLIFERAE

- Osmorhiza Claytoni* (Michx.) Clarke.—Woolly Sweet Cicely.

Cicuta maculata L.—Spotted Cowbane, Musquash Root.

bulbifera L.—Bulb-bearing Cowbane.

Carum **Carvi* L.—Caraway.

Sium cicutaefolium Schrank.—Water Parsnip.

Ligusticum scoticum L.—Scotch Lovage.

Pastinaca **sativa* L.—Parsnip.

Heracleum lanatum Michx.—Cow-parsnip.

Angelica atropurpurea L.—Angelica.

Daucus **Carota* L.—Wild Carrot.

CORNACEAE

Cornus canadensis L.—Bunchberry, "Pigeon Berry".

stolonifera Michx.—Red-osier Dogwood.

alternifolia L. f.—Alternate-leaved Dogwood.

PYROLACEAE

Chimaphila umbellata (L.) Nott.—Prince's Pine, Pipsissewa.
(Messervy).

Moneses uniflora (L.) Gray.—One-flowered Wintergreen.

Pyrola secunda L.—One-sided Wintergreen.

chlorantha Sw.—Green-flowered Wintergreen.

elliptica Nutt.—Shin-leaf.

americana Sweet.—Round-leaved Wintergreen.

uliginosa Torr.—Bog Wintergreen. (B. Hurst).

MONOTROPACEAE

Monotropa uniflora L.—Indian Pipe, Corpse-plant.

Hypopitys L.—Pinesap, False Beech Drops.

ERICACEAE

Ledum groenlandicum Oeder.—Labrador Tea.

Rhododendron canadense (L.) BSP.—Rhodora, Rosebay.

Kalmia angustifolia L.—Sheep Laurel, Lambkill.

polifolia Wang.—Pale Laurel.

Chamaedaphne calyculata (L.) Moench.—Leather Leaf.

Epigaea repens L.—Mayflower, Trailing Arbutus.

Gaultheria procumbens L.—Teaberry, Creeping Wintergreen.

Arctostaphylos Uva-ursi (L.) Spreng.—Bearberry.

Calluna **vulgaris* (L.) Hull.—Heather, Ling.

Chiogenes hispidula (L.) T. et G.—Creeping Snowberry.

- Gaylussacia baccata* (Wang.) C. Koch.—Black Huckleberry.
baccata glaucocarpa Mackenzie.—Blue Huckleberry. (Messervy).
Vaccinium pennsylvanicum Lam.—Early Sweet Blueberry.
pennsylvanicum nigrum Wood.—Low Black Blueberry. (B. Hurst).
canadense Kalm.—Sour-top, Canadian Blueberry.
Oxycoccus L.—Small Cranberry.
macrocarpon Ait.—Large or American Cranberry.

PLUMBAGINACEAE

- Limonium carolinianum* (Walt.) Britton.—Sea Lavender.

PRIMULACEAE

- Samolus floribundus* H. B. K.—Brookweed.
Trientalis americana (Pers.) Pursh.—Star Flower.
Lysimachia thyrsiflora L.—Tufted Loosestrife.
Glaux maritima L.—Sea Milkwort.
Anagallis arvensis L.—Common Pimpernel.
Centunculus minimus L.—Chaffweed. (J. Macoun).

OLEACEAE

- Fraxinus americana* L.—White Ash.
nigra Marsh.—Black Ash.
Syringa vulgaris L.—Common Lilac. (Groh).

GENTIANACEAE

- Menyanthes trifoliata* L.—Buckbean, Bog-bean. (Messervy).

APOCYNACEAE

- Apocynum androsaemifolium* L.—Spreading Dogbane.

CONVOLVULACEAE

- Convolvulus sepium* L.—Hedge Bindweed.
arvensis L.—Field Bindweed. (Messervy).

BORAGINACEAE

- Lappula echinata* Gilib.—Stickseed. (Groh).
Symphytum officinale L.—Common Comfrey. (Groh).

- Myosotis laxa* Lehm.—Smaller Forget-me-not.
arvensis (L.) Hill.—Field Scorpion-grass. (Groh).
*Lycopsis *arvensis* L.—Small Bugloss. (J. Macoun).

LABIATAE

- Scutellaria lateriflora* L.—Mad-dog Skullcap.
galericulata L.—Marsh Skullcap.
*Nepeta *Cataria* L.—Catnip.
**hederacea* (L.) Trevisan.—Ground Ivy.
Prunella vulgaris L.—Self-heal, Heal-all.
*Galeopsis *Tetrahit* L.—Common Hempnettle.
*Leonurus *Cardiaca* L.—Common Motherwort.
Stachys palustris L.—Woundwort.
*Thymus *Serpillum* L.—Common Thyme. (B. Hurst).
Lycopus uniflorus Michx.—Common Bugleweed. (B. Hurst).
americanus Muhl.—Cut-leaved Bugleweed.
*Mentha *gentilis* L.—Downy Whorled Mint. (Groh).
arvensis canadensis (L.) Briquet.—American Wild Mint.

SOLANACEAE

- Solanum nigrum* L.—Common Nightshade.
*Nicandra *Physalodes* (L.) Pers.—Apple of Peru.
*Datura *Stramonium* L.—Thorn-apple, Jimson Weed.

SCROPHULARIACEAE

- Verbascum *Thapsus* L.—Common Mullein.
*Linaria *vulgaris* L.—Butter and Eggs, Yellow Toadflax.
**minor* (L.) Desf.—Lesser Toadflax. (Groh).
Pentstemon hirsutus (L.) Willd.—Beard-tongue.
Chelone glabra L.—Turtlehead, Balmoney.
Mimulus ringens L.—Square-stemmed Monkey Flower.
moschatus Dougl.—Musk Plant. (Messervy).
Limosella aquatica tenuifolia (Wulf.) Pers.—Mudwort.
Veronica Anagallis-aquatica L.—Water Speedwell.
americana Schwein.—American Brooklime.
officinalis L.—Common Speedwell.
serpyllifolia L.—Thyme-leaved Speedwell.
**arvensis* L.—Corn Speedwell.
**Tournefortii* C. C. Gmel.—Buxbaum's Speedwell.
Melampyrum lineare Lam.—Cow Wheat.

- Euphrasia americana* Wettst.—Hairy Eyebright. (Groh).
*Odontites *rubra* Gilib.—Red Bartsia.
Rhinanthus Crista-galli L.—Yellow Rattle.

LENTIBULARIACEAE

- Utricularia cornuta* Michx.—Horned Bladderwort. (Messervy).
minor L.—Smaller Bladderwort. (J. Macoun).

PLANTAGINACEAE

- Plantago major* L.—Common Plantain.
decipiens Barneoud.—Seaside Plantain.
**lanceolata* L.—Rib grass, English Plantain.

RUBIACEAE

- Galium palustre* L.—Marsh Bedstraw. (B. Hurst).
trifidum L.—Small Bedstraw.
asprellum Michx.—Rough Bedstraw.
triflorum Michx.—Sweet-scented Bedstraw.

CAPRIFOLIACEAE

- Diervilla Lonicera* Mill.—Bush Honeysuckle.
Lonicera caerulea L.—Mountain Fly Honeysuckle. (B. Hurst).
canadensis Marsh.—American Fly Honeysuckle.
Symphoricarpus racemosus Michx.—Snowberry. (Groh).
Linnaea borealis L. var. *americana* (Forbes) Rehder.—Twin-flower.
Viburnum Opulus L. var. *americanum* (Mill.) Ait.—Cranberry-tree,
Pimbina. (B. Hurst).
acerifolium L.—Arrow-wood. (Bain).
cassinoides L.—Withe-rod.
Sambucus canadensis L.—Common Elder. (B. Hurst).
racemosa L.—Red-berried Elder.

CUCURBITACEAE

- Echinocystis *lobata* (Michx.) T. et G.—Balsam Apple, Wild Cucumber.
(Groh).

CAMPANULACEAE

- Campanula *rapunculoides* L.—Creeping Bellflower. (Groh).

LOBELIACEAE

- Lobelia spicata* Lam.—Spiked Lobelia.
inflata L.—Indian Tobacco.

COMPOSITAE

- Eupatorium purpureum* L.—Joe-Pye Weed.
perfoliatum L.—Thoroughwort, Boneset.
Solidago bicolor L.—White-rayed Golden-rod.
hispida Muhl.—Hairy Golden-rod.
puberula Nutt.—Downy Golden-rod.
uliginosa Nutt.—Bog Golden-rod.
sempervirens L.—Salt-marsh Golden-rod.
rugosa Mill.—Wrinkled-leaf Golden-rod.
canadensis L.—Canada Golden-rod.
serotina Ait.—Late Golden-rod.
graminifolia (L.) Salisb.—Grass-leaved Golden-rod.
Aster macrophyllus L.—Large-leaved Aster.
cordifolius L.—Blue Wood Aster.
laevis L.—Smooth Aster.
lateriflorus (L.) Britton.—Calico Aster.
salicifolius Ait.—Willow Aster.
tardiflorus L.—Northeastern Aster. (B. Hurst).
puniceus L.—Purple-stem Aster.
umbellatus Mill.—Umbellate White Aster.
acuminatus Michx.—Whorled Aster.
subulatus Michx.—Annual Salt-marsh Aster. (J. Macoun).
novi-Belgii L. var. *litoreus* Gray.—New York Aster. (J. Macoun).
Erigeron ramosus (Walt.) BSP.—Daisy Fleabane.
canadensis L.—Horse-weed, Butter-weed.
Antennaria plantaginifolia (L.) Richards.—Plantain-leaved Everlasting.
petaloidea Fernald.—Petaloid Everlasting. (Groh).
Anaphalis margaritacea (L.) B. et H.—Pearly Everlasting.
Gnaphalium polycephalum Michx.—Common Everlasting.
uliginosum L.—Low Cudweed.
sylvaticum L.—Wood Cudweed. (Groh).
Ambrosia trifida L.—Great Ragweed. (Groh).
artemisiifolia L.—Hogweed, Roman Wormwood.
Rudbeckia hirta L.—Black-eyed Susan, Yellow Daisy.
*Helianthus *annuus* L.—Common Sunflower.
**tuberosus* L.—Artichoke. (Groh).

Bidens frondosa L.—Common Beggar-ticks.

connata Muhl.—Swamp Beggar-ticks.

cernua L.—Smaller Burr-marigold.

Achillea **Ptarmica* L.—Sneezewort.

Millefolium L.—Common Yarrow.

Matricaria **inodora* L.—Scentless Mayweed.

 **suaveolens* (Pursh.) Buchenau.—Pineapple-weed. (B. Hurst).

Chrysanthemum **Leucanthemum* L. var. *pinnatifidum* Lecoq. et Lamotte.
 —Ox-eye Daisy.

 **Parthenium* (L.) Bernh.—Feverfew. (Groh).

Tanacetum **vulgare* L.—Common Tansy.

Artemisia **vulgaris* L.—Common Mugwort. (Groh).

 **Stelleriana* Bess.—Beach Wormwood. (Groh).

 **Absinthium* L.—Wormwood. (Groh).

 **gnaphalodes* Nutt.—Prairie Wormwood. (Groh).

Tussilago **Farfara* L.—Coltsfoot. (R. R. Hurst).

Petasites *palmatus* (Ait.) Gray.—Sweet Coltsfoot.

Senecio **vulgaris* L.—Common Groundsel.

 **viscosus* L.—Viscous, or Fetid Groundsel. (Groh).

 **Jacobaea* L.—Tansy Ragwort.

aureus L.—Golden Ragwort.

Balsamitae Muhl.—Balsam Ragwort.

 **sylvaticus* L.—Wood Groundsel. (B. Hurst).

 (First specimen in National Herbarium, Ottawa, sent from P.E.I., 1926.)

Arctium **minus* Bernh.—Common Burdock. (Groh).

Cirsium **lanceolatum* (L.) Hill.—Bull Thistle.

discolor (Muhl.) Spreng.—Field Thistle. (Bain).

muticum Michx.—Swamp Thistle. (Groh).

 **arvense* (L.) Scop.—Canada Thistle.

Centaurea **nigra* L.—Knapweed.

Lapsana **communis* L.—Nipplewort.

Cichorium **Intybus* L.—Chicory.

Leontodon **autumnalis* L.—Fall Dandelion.

Taraxacum **officinale* Weber.—Dandelion.

Sonchus **oleraceus* L.—Common Sow Thistle.

 **asper* L.—Spiny Sow Thistle. (Groh).

 **arvensis* L.—Field Sow Thistle.

 (In 1926 Mr. Groh found the pest of western grain fields, *Sonchus arvensis glabrescens* Gunth. abundant in P.E.I.)

Lactuca canadensis L.—Wild Lettuce.

integrifolia Bigel.—Simple-leaved Lettuce.

- hirsuta* Muhl.—Hairy Lettuce.
spicata (Lam.) Hitchc.—Tall Blue Lettuce.
Prenanthes alba L.—Rattlesnake-root.
trifoliolata (Cass.) Fernald.—Lion's-foot, Gall-of-the-Earth. (Bain).
*Hieracium *Pilosella* L.—Mouse-ear Hawkweed. (B. Hurst).
**aurantiacum* L.—Devil's Paint-brush. (B. Hurst).
**floribundum* Wimm. et Grab.—Many-flowered Hawkweed. (Groh).
**pratense* Tausch.—King Devil. (Groh).
scabrum Michx.—Rough Hawkweed.
canadense Michx.—Canada Hawkweed. (Groh).

SPECIES DOUBTFUL OR REQUIRING CONFIRMATION

- Cinna arundinacea* L.
Polygonum pennsylvanicum L.
Suaeda linearis Moq.
Crataegus coccinea L.
**Fragaria vesca* L.
Rubus villosus Ait.
**Rosa cinnamomea* L.
Prunus pumila L.
Lechea minor L.
Viola alsophila Greene.
Viola Watsoni Greene.
Viola nesiotica Greene.
Callitriche verna L.
Cornus circinata L. 'Hér.
Lycopus virginicus L.
Solidago stricta Ait.
Solidago altissima L.
Aster multiflorus Ait.
**Arctium Lappa* L.

INDEX TO FAMILIES

| | | | | | |
|---------------------|-----|-----------------------|-----|-----------------------|-----|
| Aceraceae | 264 | Balsaminaceae | 264 | Caryophyllaceae | 259 |
| Alismaceae | 254 | Berberidaceae | 260 | Chenopodiaceae | 259 |
| Amarantaceae | 259 | Betulaceae | 257 | Cistaceae | 264 |
| Anacardiaceae | 264 | Boraginaceae | 267 | Compositae | 270 |
| Apocynaceae | 267 | Callitrichaceae | 265 | Convolvulaceae | 267 |
| Aquifoliaceae | 264 | Campanulaceae | 269 | Cornaceae | 266 |
| Araceae | 255 | Cannabaceae | 258 | Crassulaceae | 261 |
| Araliaceae | 265 | Caprifoliaceae | 269 | Cruciferae | 260 |

| | | | | | |
|------------------------|-----|------------------------|-----|------------------------|-----|
| Cucurbitaceae | 269 | Liliaceae | 256 | Portulacaceae | 260 |
| Cyperaceae | 255 | Linaceae | 263 | Primulaceae | 267 |
| Droseraceae | 261 | Lobeliaceae | 270 | Pyrolaceae | 266 |
| Empetraceae | 264 | Loranthaceae | 258 | Ranunculaceae | 260 |
| Equisetaceae | 252 | Lycopodiaceae | 253 | Rhamnaceae | 264 |
| Ericaceae | 266 | Malvaceae | 264 | Rosaceae | 262 |
| Euphorbiaceae | 263 | Monotropaceae | 266 | Rubiaceae | 269 |
| Fagaceae | 257 | Myricaceae | 257 | Salicaceae | 257 |
| Fumariaceae | 260 | Nymphaeaceae | 260 | Santalaceae | 258 |
| Gentianaceae | 267 | Oleaceae | 267 | Sarraceniaceae | 261 |
| Geraniaceae | 263 | Onagraceae | 265 | Saxifragaceae | 261 |
| Gramineae | 254 | Ophioglossaceae | 252 | Scrophulariaceae | 268 |
| Haloragaceae | 265 | Osmundaceae | 252 | Solanaceae | 268 |
| Hypericaceae | 264 | Orchidaceae | 256 | Sparganiaceae | 254 |
| Illecebraceae | 259 | Oxalidaceae | 263 | Taxaceae | 253 |
| Iridaceae | 256 | Pinaceae | 253 | Thymelaeaceae | 265 |
| Juncaceae | 256 | Plantaginaceae | 269 | Typhaceae | 253 |
| Juncaginaceae | 254 | Plumbaginaceae | 267 | Ulmaceae | 257 |
| Labiatae | 268 | Polygonaceae | 258 | Umbelliferae | 265 |
| Leguminosae | 263 | Polypodiaceae | 252 | Urticaceae | 258 |
| Lemnaceae | 255 | Pontederiaceae | 255 | Violaceae | 265 |
| Lentibulariaceae | 269 | Potamogetonaceae | 254 | | |

LIST OF THE LARGER FUNGI, TORONTO REGION

By GARNET S. BELL

Past President, Mycological Society of Ontario

For twenty years or more I have been interested in the larger fungi growing in the fields and woods around Toronto, as well as in the city itself. Their curious and various forms, the agreeable edibility of some species and the well-known dangerous toxicity of other kinds combined to hold my attention as they do that of most observers who begin to compare them or to test their dietetic reactions.

In the literature of the subject I have found what seemed satisfactory descriptions and names of 437 species that I have collected within a range of fifty miles of Toronto. Some of my interested friends have urged me to have the list printed. Hitherto the only considerable published list of the larger fungi of the district was made by Mr. Thomas Langton, M.A., LL.B. His list, which appeared in the *Natural History of the Toronto Region*, 1913, contained the names of 165 species, including 44 that are not in my list. The two lists combined furnish 481 species names.

As a rule I did not preserve the specimens after studying them, but some examples were sent to the herbarium of the University of Toronto and are preserved there. Species named in the above cited Langton list, that were not collected by me, are marked "Langton List".

It is hardly necessary to say that the terms of frequency—common, rare, etc.,—apply to the territory where I have collected. A species may be common in the section explored and rare in other parts of the country and vice versa, or common in one year and scarce or entirely absent in another. Habitat and especially time of appearance are subject to territorial and seasonal variation.

The edible qualities are given of only those species which I have personally tested. I am not unmindful that certain factors entering into edibility such as flavour, tenderness, etc., are matters of individual taste and that a fungus which one mycophagist may rate as excellent another would call only fair. Good fungi may be spoiled by poor collecting, long keeping, worm infestation or unskilful cooking. A number of species in this list, with unstated edibility, have been reported as edible by various

mycologists and no doubt there are others that will be found wholesome and appetizing when tested.

For help and encouragement I desire to express my grateful thanks to Dr. J. H. Faull, Dr. H. S. Jackson, Dr. H. C. Beardslee and especially to Dr. John Dearness of London, Ont., for making many of the more difficult identifications, valuable suggestions and for checking proof of the list.

BASIDIOMYCETES

AGARICALES

AGARICACEAE

(1) WHITE SPORED.

Amanita caesarea Fr. Rare—Open woods; Moore Park; 1922.

Amanita excelsa Fr. Rare—Open woods; High Park; Aug., 1924.

Looked exactly like fine illustrations by W. C. Coker in "Amanitas of the Eastern United States" (Journal El. Mitchell Sci. Soc., June, 1917).

Amanita frostiana Pk. Not common—On ground and rotting wood in woods; Don Valley and Glen Major; July-Sept.

Amanita gemmata (Fr.) Gill. Infrequent—On ground in woods; Don Valley and High Park; July-Sept.

Amanita mappa Fr. Infrequent—On very rotten wood in woods; south Bond Lake; Sept.-Oct. This is form (B) as described by Kauffman in "Agaricaceae of Michigan".

Amanita muscaria Linn. Very common—On ground in woods; July-Oct.

Amanita phalloides Fr. Frequent—On ground in woods; July-Sept.

Amanita rubescens Fr. Rare—Open woods; High Park; Sept., 1926.

Amanita spreata Pk. Rare—Open woods; Glen Major; Aug., 1931.

Amanita spissa Fr. Rare—Deciduous woods; Glen Major; Sept., 1924.

Amanita verna Fr. Very common—On ground in woods; Aug.-Oct.

Amanitopsis vaginata Fr. var. *fulva* Sacc. Common in woods; July-Sept.

Amanitopsis vaginata Fr. var. *alba* Sacc. Fairly common; July-Sept.

Amanitopsis vaginata Fr. var. *livida* Pk. Fairly common; July-Sept.

Amanitopsis strangulata Fr. Rare—Woods on ground; Leaside; Aug. 1932. Spores spherical 9-13 μ granular within but after standing in water for about 15 minutes some showed one distinct oil-drop and several indistinct ones. Carleton Rea says "multi-guttulate". C. H. Kauffman says "granular within".

Armillaria appendiculata Pk. Rare—On ground, damp woods; Glen

Major; Aug.-Oct. Find one location only. Occasionally larger than measurements in Peck's description. Pileus up to 13 cm. broad; stem 12 cm. long.

Armillaria aurantia Fr. Infrequent—On ground; woods, Glen Major and Bond Lake; Aug.-Oct.

Armillaria dryina Fr.-Pat. Langton list, as *Pleurotus dryinus* Pers.

Armillaria mellea Fr. Abundant—On both living and dead wood; May-Nov. (Early record, May 13, 1922, York Mills.) Edible but not of delicate flavour; fair, baked with cheese.

Cantharellus aurantiacus Fr. Frequent—In woods on ground and on decayed wood; Glen Major and Bond Lake; Aug.-Oct. Edible, good.

Cantharellus cibarius Fr. Common—On ground in woods; July-Sept. Edible, excellent.

Cantharellus cinnabarinus Schw. Infrequent—Woods on ground; Bond Lake and Glen Major; Aug.-Oct.

Cantharellus floccosus Schw. Rare—Pine woods on ground; Glen Major; Aug.

Cantharellus infundibuliformis Fr. Infrequent—On ground in damp woods; Glen Major; July-Sept.

Cantharellus lutescens Bull. Langton list.

Cantharellus umbonatus Fr. Infrequent—In and attached to moss; Bond Lake; Sept.-Nov.

Clitocybe albissima Pk. Frequent—On ground under conifers; Don Valley and Glen Major; July-Oct. Flavor poor, bitterish.

Clitocybe candida Bres. Infrequent—On ground under conifers; Don Valley and Glen Major; Aug.-Sept. Fair only, requires to be well seasoned.

Clitocybe clavipes Fr. Infrequent—On ground under pines; Glen Major; Sept.-Oct.

Clitocybe dealbata Fr. Infrequent—In pastures; Glen Major; Oct.

Clitocybe dealbata Fr. var. *sudorifica* Pk. Don Valley on sawdust; Sept. Have known it to be eaten with usual result of some hours' profuse perspiration.

Clitocybe decastes Fr. Langton list.

Clitocybe eccentrica Pk. Rare—Don Valley; Sept., 1925.

Clitocybe gilva Pers. Langton list.

Clitocybe illudens Schw. Frequent—Decaying stumps and roots; Don Valley and Erindale; Sept.

Clitocybe infundibuliformis (Schaeff.) Fr. Common—Wood on ground; July-Oct. Tender and of good flavour.

- Clitocybe maxima* Fr. Infrequent—On ground in open woods; Bond Lake and Glen Major; Aug.
- Clitocybe media* Pk. Langton list. Kauffman regards this as a variety of *C. clavipes* Fr.
- Clitocybe multiceps* Pk. Common—Woods and open ground; July-Oct. Good when young.
- Clitocybe nebularis* Fr. Infrequent—Ground in woods; Bond Lake and Glen Major; Sept. Oct.
- Clitocybe odora* Fr. All types, white, greenish and bluish; white commonest; July-Oct. Edible, highly flavoured alone; good with others.
- Clitocybe piceina* Pk. Common—Ground under conifers; Don Valley and Glen Major; July-Sept.
- Clitocybe robusta* Pk. Langton list.
- Clitocybe subconnexa* Mur. Rare—Ground in woods; Glen Major; Oct., 1924.
- Clitocybe subnigricans* Pk. Rare—Ground in woods; Glen Major; Oct., 1925.
- Collybia albiflavida* Pk. Frequent—Ground in woods; June-Sept.
- Collybia butyracea* Fr. Frequent—Woods under hemlocks; June-Oct. Edible and good.
- Collybia confluens* Fr. Frequent—Woods on ground; July-Oct. Edible, excellent.
- Collybia dryophila* Fr. Abundant—Woods on ground; June-Oct. Edible, excellent.
- Collybia hariolorum* Fr. Infrequent—Woods on ground; Don Valley Sept., 1931.
- Collybia longipes* Fr. Frequent—Woods on ground and decayed wood; Aug.-Sept. Edible, excellent.
- Collybia platyphylla* Fr. Common—On rotting wood; June-July. Edible, only fair.
- Collybia radicata* Fr. Very common—Ground in woods and clearings; June-Oct. Edible, excellent.
- Collybia strictipes* Pk. Rare—Wood on ground; Maple; Sept., 1919.
- Collybia velutipes* Fr. Abundant—On living and decaying wood; all year but most abundant in the fall. Edible and of good flavour.
- Hygrophorus chlorophanus* Fr. Frequent—Damp woods; Don Valley; June-Aug. Edible, fair, rather watery.
- Hygrophorus chrysodon* Fr. Infrequent—Ground, open woods; Don Valley; Sept.-Oct.
- Hygrophorus coccineus* Fr. Frequent—Ground, damp woods; Don Valley and Glen Major; Aug.-Oct.

- Hygrophorus conicus* Fr. Common—In moist woods on ground; June-Sept. Have eaten and found harmless. Suspected, advise caution.
- Hygrophorus eburneus* (Bull.) Fr. Common—Ground in woods; Don Valley and Glen Major; Sept.-Oct. Edible and good if well cooked.
- Hygrophorus flavodiscus* Frost. Rare—Ground in pine woods; Glen Major; Sept., 1924.
- Hygrophorus marginatus* Pk. Frequent—Ground in damp woods; June-Aug.
- Hygrophorus miniatus* Fr. Frequent—Ground in damp woods; July-Sept.
- Hygrophorus miniatus* var. *cantherellus* Schw. Frequent—Damp wood; Aug.-Sept. Both *C. miniatus* and variety edible; small but excellent.
- Hygrophorus nitidus* B. & C. Rare—Woods; Miner's Bay, Haliburton; Aug., 1929.
- Hygrophorus niveus* Fr. Rare—On ground in damp woods; Glen Major; Aug., 1932.
- Hygrophorus pratensis* Fr. Frequent—Ground in woods; Don Valley and Glen Major; July-Oct.
- Hygrophorus psittacinus* Fr. Infrequent—Ground in woods; Don Valley and Glen Major; July-Oct.
- Hygrophorus puniceus* Fr. Frequent—Ground in wet woods; Don Valley and Glen Major; July-Oct.
- Hygrophorus puniceus* var. *flavescens* Kauff. Rare—Ground in damp woods; Midhurst; Aug., 1932.
- Hygrophorus purus* Pk. Rare—Under pines; Glen Major; Sept., 1922. Stem solid; Peck says hollow.
- Hygrophorus russula* Fr. Infrequent—Ground in woods; Bond Lake; Aug.-Oct.
- Hygrophorus virgineus* Fr. var. Infrequent—Ground in woods; Bond Lake; Sept.
- Laccaria laccata* (Scop.) Berk. Common everywhere—June-Oct. Edibility fair.
- Laccaria laccata* var. *amethystina* Bolt. Common—June-Oct. Edibility fair.
- Laccaria ochropurpurea* (Berk.) Pk. Frequent—Both woods and open grassy places; July-Sept. Edible; fine fried.
- Laccaria tortilis* (Bolt.) B. & Br. Infrequent—On ground in damp woods; Don Valley; July-Aug.
- Lactarius camphoratus* (Bull.) Fr. Infrequent—On very decayed wood; Don Valley; July-Aug.
- Lactarius chrysorheus* Fr. Rare—In woods on ground; Don Valley; Aug., 1922.

- Lactarius cilicioides* Fr. Rare—In woods on ground; Don Valley; Sept., 1925.
- Lactarius cinereus* Pk. Rare—On ground in mixed woods; Midhurst; Aug., 1932.
- Lactarius controversus* Fr. Infrequent—Woods on ground; Erindale and Glen Major; Sept.
- Lactarius deceptivus* Pk. Infrequent—On ground under hemlocks; Bond Lake; Aug.-Sept.
- Lactarius deliciosus* Fr. Common—On ground under conifers; July-Nov. Edible and good.
- Lactarius griseus* Pk. Infrequent—On decayed wood in woods; Don Valley and Midhurst; Aug.
- Lactarius hygrophoroides* B. & C. Infrequent—Woods on ground; Erindale; Aug.-Sept. Edibility excellent.
- Lactarius hyssiginus* Fr. Common—Woods on ground and decayed wood; July-Oct.
- Lactarius indigo* Schw. Infrequent—Woods on ground; Erindale and Glen Major; July-Oct. Edible, excellent.
- Lactarius insulsus* Fr. Infrequent—On ground in deciduous woods. Have found up to 20 cm. wide across pileus. Spores globose 7.3-9.4 μ ; July-Aug.
- Lactarius isabellinus* Burl. Rare—On ground in damp woods; Don Valley; Aug., 1932.
- Lactarius pergamenus* Fr. Infrequent—On ground in open woods; Bond Lake and Moore Park; Aug.
- Lactarius piperatus* Fr. Common—On ground in woods; July-Sept. Edibility doubtful; said to be edible if first parboiled.
- Lactarius quietus* Fr. Rare—On ground in woods; Glen Major; Aug., 1932. Agrees well with description by Miss Burlingham. ("N. Am. Flora").
- Lactarius scrobiculatus* (Scop.) Fr. Rare—On ground in damp woods; Don Valley; Aug., 1932.
- Lactarius subdulcis* Fr. Frequent—On ground in woods; Moore Park and Glen Major; July-Aug.
- Lactarius subpurpureus* Pk. Rare—On ground under hemlocks; Don Valley and Singhampton; Sept.-Oct.
- Lactarius subvellereus* Pk. Rare—On ground in woods; Langstaff; Aug., 1928.
- Lactarius theiogalus* Fr. Langton list.
- Lactarius trivialis* Fr. Very common—On ground in woods; July-Aug; Edibility very poor.
- Lactarius torminosus* Fr. Very common—On ground in woods; Aug.-Oct.

- Lactarius uvidus* Fr. Rare—Wet woods in moss; Midhurst; Aug., 1928.
Lactarius vellereus Fr. Infrequent—On ground in woods; Don Valley and Bond Lake; Aug.
Lactarius volemus Fr. Frequent—On ground in woods; Moore Park and Bond Lake; July-Aug. Edible, excellent.
Lentinus cochleatus Fr. Infrequent—On decaying wood; Don Valley and Bond Lake; Aug.
Lentinus lepideus Fr. Common—On old timbers, railway ties, etc.; July-Sept. Edible, fair when young.
Lentinus vulpinus Fr. Infrequent—On decaying wood; Don Valley; Sept.
Lepiota acutaesquamosa Fr. Frequent—On ground in woods; Don Valley and Glen Major; Aug.-Sept.
Lepiota adnatifolia Pk. Frequent—On ground in woods; Glen Major; Aug.-Sept.
Lepiota americana Pk. Frequent—Open grassy places; Don Valley; Aug.-Sept. Edible, excellent.
Lepiota clypeolaria Fr. Infrequent—Wood on ground; Glen Major; Oct.
Lepiota cristata Fr. Common—On ground, both woods and open places; July-Sept.
Lepiota felina Fr. Rare—On ground in woods; Sept., 1925.
Lepiota fischeri Kauff. Rare—On ground in woods; Glen Major; Oct., 1925.
Lepiota friesii Lasch. Infrequent—On decaying wood; Bond Lake and Midhurst; Aug.-Sept.
Lepiota gloioderma Fr. Rare—Wood on ground; Glen Major; Aug., 1924.
Lepiota gracilentia Krombh. Langton list.
Lepiota granulosa Fr. Infrequent—Woods under pines; Kelly Lake and Glen Major; Sept.
Lepiota granulosa var. *albida*. Infrequent—Woods; Glen Major; Aug., 1931.
Lepiota morgani Pk. On ground at Grand Bend and Muskoka. Have not found it in Toronto Region but may occur here.
Lepiota naucina Fr. Common—Open grassy places; Aug.-Nov. Edibility excellent.
Lepiota procera Fr. Common—Pastures and open woods; Aug.-Oct. Edibility excellent.
Lepiota pusillomyces Pk. Rare—Woods on ground; Glen Major; Sept., 1926.
Lepiota rubrotincta Pk. Infrequent—On ground in woods; Don Valley; July-Sept.
Lepiota rugoso-reticulata Lorin. Rare—On ground, edge of woods; S.

- of Bond Lake; Sept., 1932. The rugose-reticulate character of pileus very pronounced in some specimens and lacking in others.
- Marasmius cohaerens* (Fr.) Bres. Infrequent—In grass at edge of woods; Klineburg; Sept.
- Marasmius glabellus* Pk. Infrequent—Woods on ground; Glen Major; Aug.-Sept.
- Marasmius oreades* Fr. Abundant—Grassy fields; June-Nov. Edible, excellent.
- Marasmius rotula* Fr. Common—On dead leaves, twigs, bark, etc.; July-Sept.
- Marasmius velutipes* B. & C. Frequent—Woods on ground in leaves; Bond Lake and Glen Major; July-Aug.
- Mycena ammoniaca* Fr. Infrequent—On rotting logs; near Oshawa; June.
- Mycena galericulata* Fr. Common—On rotten wood; June-Oct.
- Mycena haematopa* Fr. Infrequent—On rotten wood; Don Valley; Aug.-Sept.
- Mycena leaiana* Berk. Frequent—On decaying wood; Don Valley and Glen Major; June-Sept.
- Mycena pura* Fr. Common—Woods on ground; Bond Lake and Glen Major; July-Sept.
- Nyctalis asterophora* Fr. Frequent—On *Russula nigricans* and *R. densifolia*; Aug.
- Omphalia campanella* Fr. Abundant—On decaying conifers; May-Oct.
- Omphalia epichysium* Fr. Infrequent—On rotting wood; Sept.
- Omphalia umbellifera* Linn. Langton list.
- Panus angustatus* Berk. Rare—On dead elm; Humber Valley near King; July, 1933.
- Panus rudis* Fr. Common—On dead wood; June-Oct.
- Panus stipticus* Fr. Common—On dead wood; June-Oct.
- Panus strigosus* B. & C. Infrequent—On dead wood; Bond Lake; Aug.
- Panus torulosus* Fr. Infrequent—On dead wood; Bond Lake and Don Valley; June-July.
- Pleurotus albolanatus* Pk. Rare—On decaying wood; Don Valley; Oct., 1922.
- Pleurotus elongatipes* Pk. Rare—On decaying log; Don Valley; Nov., 1932.
- Pleurotus ostreatus* Fr. Very common—On dead deciduous wood, especially poplar; May-Nov. Edibility good.
- Pleurotus petaloides* Fr. Langton list.
- Pleurotus sapidus* Kalchb. Infrequent — On dead deciduous wood; Maple; Sept. Edible, good.

- Pleurotus scrotinus* Fr. Common—On dead deciduous wood; Oct.-Nov.
Pleurotus subpalmatus Fr. Rare—Collected by Mr. Connon; June, 1922.
Pleurotus sulphureoides Pk. Langton list.
Pleurotus ulmarius Fr. Common—On living and dead elm, maple, etc.; Sept.-Nov.
Russula abietina Pk. Rare—Woods, under or near balsam; Glen Major; July, 1932.
Russula aeruginea Lindb. Infrequent—Woods on ground; Bond Lake and Glen Major; July-Sept.
Russula albella Pk. Rare—Woods on ground; Midhurst and Singhampton; Aug.-Sept.
Russula alutacea Fr. Infrequent—Woods on ground; Bond Lake and Glen Major; July-Aug.
Russula amygdaloides Kauff. Infrequent—Woods on ground; Scarborough and Glen Major; Sept.-Oct.
Russula atropurpurea Pk. Langton list.
Russula aurata Fr. Langton list.
Russula borealis Kauff. Rare—Woods on ground; Moore Park; Aug., 1932.
Russula crustosa Pk. Infrequent—Woods on ground; Moore Park and Glen Major; Aug.-Sept. Spores of specimens found in 1932 were somewhat smaller than size given by Peck. Mine measured 6-7.3 μ .
Russula cyanoxantha Fr. Langton list.
Russula delicata Fr. Infrequent—Woods on ground; Don Valley; Sept.
Russula densifolia (Secr.) Gill. Rare—Woods on ground; Moore Park and Midhurst; Aug.
Russula emetica Fr. Common—Woods on ground; July-Sept. Edible and as good as any *Russula*.
Russula fallax Cke. Frequent—Low ground in moss; Don Valley; July-Sept.
Russula flava Romell. Frequent—Woods on ground; Glen Major; July-Aug.
Russula foetens Fr. Common—Woods on ground; Don Valley and Glen Major; July-Aug.
Russula fragilis Fr. Infrequent—Woods on ground; Don Valley and Glen Major; Aug. Edible, good.
Russula heterophylla Fr. Langton list.
Russula integra Fr. Infrequent—Woods on ground; Bond Lake; Aug.
Russula mariae Pk. Infrequent—Woods on ground; Glen Major; Sept.
Russula nigricans Fr. Infrequent—Woods on ground; Moore Park and Glen Major; Aug.-Sept.

- Russula pectinatoides* Pk. Infrequent—Woods on ground; Bond Lake; July.
- Russula purpurina* Quel. & Schulzer. Infrequent—Woods on ground; Don Valley and Glen Major; July-Nov.
- Russula roseipes* (Secr.) Bres. Infrequent—Woods on ground; Don Valley and Bond Lake; July-Sept.
- Russula subpunctata* Kauff. Rare—Woods on ground; Don Valley; July, 1924.
- Russula tenuiceps* Kauff. Rare—Woods on ground; Midhurst; July, 1928.
- Russula uncialis* Pk. Rare—Woods on ground; Bond Lake; Aug., 1931.
- Russula variata* Banning & Pk. Rare—Woods under pines; Glen Major and Midhurst; Aug.
- Russula virescens* Fr. Frequent—Woods on ground; Glen Major; July-Aug.
- Schizophyllum commune* Fr. Common—On dead deciduous trees; July-Oct.
- Tricholoma acerbum* Fr. Frequent—Woods on ground; Glen Major; July-Aug.
- Tricholoma album* Schaeff. Langton list.
- Tricholoma brevipes* Fr. Frequent—Open woods in sandy soil; Don Valley and Glen Major; Aug.-Nov. Edibility good.
- Tricholoma carneum* Fr. Rare—Woods on ground; Oct., 1932. Spores oblong $4.5-6 \times 2.5-3 \mu$, somewhat larger than given by Kauffman, but agreeing with measurements given by C. Rea.
- Tricholoma chrysenteroides* Pk. Rare—Sept., 1923.
- Tricholoma equestre* Fr. Frequent—Woods on ground; Bond Lake and Glen Major; Sept.-Oct.
- Tricholoma laterarium* Pk. Rare—Woods on ground; Don Valley; Sept., 1922.
- Tricholoma melaleucum* Fr. Infrequent—In grass at edge of woods; Aug.
- Tricholoma panaeolum* var. *caespitosum* Bres. Common—Woods on ground; July-Sept.
- Tricholoma personatum* Fr. Common—Woods on ground; Sept.-Nov. Edible, good when not water soaked.
- Tricholoma rutilans* Fr. Frequent—On dead conifers; Bond Lake and Glen Major; July-Sept.
- Tricholoma terreum* Fr. Frequent—Open woods on ground. Fits description as given by Kauffman. Occasionally specimens are met with that agree except in spores which are $6-7 \times 5-6 \mu$.
- Tricholoma transmutans* Pk. Infrequent—Woods on ground; Glen Major; Aug.-Oct. Edible, good.
- Trogia crispa* Fr. Infrequent—On dead deciduous trees; Sept.

(2) PINK SPORED.

- Claudopus nidulans* Fr. Infrequent—On dead deciduous wood; Muskoka; Nov. Langton reports for Toronto Region.
- Clitopilus abortivus* B. & C. Common—Woods and open grassy places; Sept.-Oct.
- Clitopilus caespitosus* Pk. Rare—Woods on ground; Don Valley; Sept., 1928.
- Clitopilus novaboracensis* Pk. Rare—Woods on ground; Bond Lake; Aug., 1931.
- Eccilia subacus* Pk. Rare—Woods South of Bond Lake; July, 1931.
- Entoloma clypeatum* Fr. Infrequent—Woods on ground; Don Valley and Bond Lake; Aug.-Sept.
- Entoloma grayanum* Pk. Rare—Woods; Don Valley; Spores 5-6 angled, 8-10×7-9 μ , including *apiculus* which stands out straight. Flesh scissile; Aug., 1932.
- Entoloma griseum* Pk. Infrequent—Low woods on ground; Don Valley and Glen Major; July-Sept.
- Entoloma peckianum* Burt. var. Rare—Low woods on ground; Glen Major; Oct., 1931.
- Entoloma sericatum* Britz. Infrequent—Ground, mixed woods; Eglington and Glen Major; July-Aug.
- Leptonia incana* Fr. Infrequent—Ground, damp woods; Don Valley and Glen Major; June-Sept. Odor mousey.
- Leptonia seticeps* Atk. Infrequent—On rotting wood; Sept.
- Pluteus admirabilis* Pk. Rare—On decaying logs; Don Valley; July, 1924.
- Pluteus cervinus* Fr. Common—On decaying logs, stumps, etc.; June-Oct. Edible, good.
- Pluteus flavofuliginus* Atk. Rare—On well rotted wood in woods; Glen Major; Aug., 1933.
- Pluteus granularis* Pk. Infrequent—On rotten logs; Don Valley; July-Aug.
- Pluteus leoninus* Fr. Infrequent—On rotten logs; Bond Lake and Glen Major; June-Aug.
- Pluteus longistriatus* Pk. Rare—On rotting stump; Yonge St. and Balmoral Ave.; July, 1922.
- Pluteus roseocandidus* Atk. Rare—On ground in moist woods; Humber Valley near King; July, 1933.
- Pluteus salicinus* Fr. var. Rare—On ground in moist woods; Glen Major; July, 1923.
- Pluteus tomentosulus* Pk. Rare—On rotting willow in wet place; Don Valley; July, 1932.

Pluteus umbrosus Fr. Infrequent—On rotting logs and sawdust; Don Valley and Glen Major; Sept.-Oct.

Volvaria bombycina Fr. Rare—On rotting wood; High Park and Don Valley; July.

Volvaria gloiocephala Fr. Rare—Brought to Mycological meeting; June, 1928.

Volvaria pubescentipes Pk. Infrequent—On ground, mixed woods; Bond Lake; Aug.

Volvaria speciosa Fr. Rare—On ground in woods; Don Valley; Sept., 1930.

(3) OCHRE SPORED.

Cortinarius alboviolaceus Fr. Frequent—Ground in thick woods; Glen Major; Sept.-Oct.

Cortinarius armillatus Fr. Frequent—Woods in rich soil; Bond Lake; Aug.-Oct.

Cortinarius elegantior Fr. Rare—Wood on ground; Don Valley; Sept., 1925.

Cortinarius juberinus Fr. Infrequent—Wood in wet sandy soil; Glen Major; May, 1930.

Cortinarius lilacinus Pk. Infrequent—Wood on ground; Bond Lake; Aug.-Sept.

Cortinarius mucifluus Fr. Infrequent—Wood on ground; Don Valley; Sept.

Cortinarius pholideus Fr. Infrequent—Wood on ground; Bond Lake; Sept.

Cortinarius sanguineus Fr. Rare—Brought to Mycological meeting; Sept., 1930.

Cortinarius semisanguineus Fr. Infrequent—Woods on ground; Don Valley and Glen Major; Aug.-Oct.

Cortinarius squamulosus Pk. Langton list.

Crepidotus applanatus Fr. Rare—On rotten log; Midhurst; Aug., 1932.

Crepidotus fulvo-tomentosus Pk. Common—On decaying wood of deciduous trees; June-Oct.

Crepidotus haerens Pk. Rare—On decaying stump; Don Valley; July, 1922.

Crepidotus malachius B. & C. Infrequent—On decaying logs, etc.; Glen Major; July.

Crepidotus versutus Pk. Infrequent—Brought to Mycological meeting, Sept., 1930, and also reported in Langton list.

Flammula spumosa Fr. Rare—On very rotten log; Glen Major; Oct., 1932.

- Galera tenera* Fr. Frequent—Open grassy places; June-Aug.
- Hebeloma fastibile* Fr. Rare—Growing in greenhouse; June, 1920, and May, 1923.
- Hebeloma pascuense* Pk. Rare—On gravelly soil in open field; Scarboro Bluffs; May, 1933.
- Hebeloma sinapizans* Fr. Frequent—On ground in open woods; Don Valley and Glen Major; Oct.
- Inocybe fastigiata* Bres. Frequent—On ground in mixed woods; July-Aug.
- Inocybe lilacina* Fr. Rare—On ground in mixed woods; Glen Major; Sept., 1932.
- Inocybe pyriodora* Fr. Rare—On ground in mixed woods; Don Valley; Sept., 1932.
- Inocybe scabra* (Mull.) Fr. Rare—On ground in mixed woods; Glen Major; Sept., 1932. Spore shape and size agree with that given by C. Rea in *Br. Basidiomycetae*.
- Naucoria semiorbicularis* Fr. Common—Pastures, lawns, etc.; May-July.
- Paxillus atrotomentosus* Fr. Common—On rotting coniferous wood; May-Sept. Tomentum on young plants often mauve colour; this not noted in description.
- Paxillus involutus* Fr. Common—Open places or woods on ground; July-Oct.
- Paxillus panuoides* Fr. Infrequent—On decaying coniferous wood; Don Valley; Aug.-Oct.
- Paxillus rhodoxanthus* Schw. Rare—Woods near Port Credit; Sept., 1923.
- Pholiota adiposa* Fr. Frequent—On old stumps; Don Valley; Aug.-Oct.
- Pholiota albocrenulata* Pk. Rare—On base of living poplar; Glen Major; Aug., 1932.
- Pholiota aurivella* Fr. Rare—On rotting wood; Glen Major; Sept., 1930.
- Pholiota cerasina* Pk. Infrequent—Rotting stumps; Glen Major and Midhurst; July-Aug.
- Pholiota johnsoniana* (Pk.) Atk. Rare—Woods on ground; Don Valley; June, 1926.
- Pholiota marginata* (Batsch.) Fr. Infrequent—On decaying wood; Glen Major and King; May-Oct.
- Pholiota praecox* Fr. Common—On ground in open places; June-July. Under this name are included forms sometimes referred to *P. dura* Fr. Edible, excellent.
- Pholiota squarrosa* Fr. Infrequent—On decaying wood; Don Valley and Aurora; Aug.-Sept.

- Pholiota squarrosoides* Pk. Frequent—On decaying wood; Don Valley and Port Credit; Aug.-Sept. Edible but strong flavoured.
Pluteolus reticulatus Fr. Rare—Brought to Mycological meeting; Oct., 1917.

(4) PURPLE SPORED.

- Hypholoma appendiculatum* Fr. Frequent—Open woods on ground; Don Valley and Bond Lake; June-Aug.
Hypholoma capnoides Fr. Infrequent—Wood on ground; Don Valley and Port Credit; Sept.-Oct.
Hypholoma incertum Pk. Very common—Grassy places, usually near base of tree; June-Sept. Edibility excellent.
Hypholoma incertum var. *sylvestris* Kauff. Frequent—Ground in woods; Don Valley; July-Aug.
Hypholoma lachrymabundum (Fr.) Quel. Rare—Woods; Don Valley; July, 1931. Not always caespitose.
Hypholoma rugocephalum Atk. Rare—Collected by F. W. Fraser; Sept., 1925.
Hypholoma sublateralitium Fr. Common—Round base of stumps; Aug.-Nov. Edible, excellent, sometimes bitter.
Psalliota abruptibulba Pk. Common—Mixed woods on ground; July-Oct. Highly flavoured but good.
Psalliota arvensis Fr. Frequent—Open grassy places; July-Oct. Edibility excellent.
Psalliota campestris Fr. Frequent—Open grassy places; Aug.-Oct. Edibility excellent.
Psalliota comtula Fr. Rare—Woods on ground; Don Valley; July, 1932. Spores $3.5-5 \times 3-3.5 \mu$, 1-guttulate.
Psalliota haemorrhodaria Fr. Rare—Woods on ground; Humber Valley near King; Aug., 1928.
Psalliota magnifica Pk. Langton list.
Psalliota placomyces Pk. Infrequent—Woods on ground; Don Valley and Glen Major; Aug.-Sept. Edible but of variable quality.
Psalliota rodmani Pk. Frequent—On lawns and pastures; July-Nov. Edibility excellent.
Psalliota silvatica Fr. Langton list.
Psalliota subrufescens Pk. Infrequent—Wood on ground; Don Valley and Glen Major; July-Oct. Have found examples up to 19.5 cm. broad. Edible, good.
Psilocybe foenisecii Fr. Frequent—Lawns and pastures; July-Sept.
Psilocybe larga Kauff. Rare—Around old stump near King City; May, 1931, and Oct., 1932.

Stropharia bilamellata Pk. Rare—Woods on ground; Klineburg and Don Valley; Oct.

Stropharia depilata Fr. Rare—Woods on ground; Glen Major; Oct., 1930.

Stropharia epimyces (Pk.) Atk. Rare—Parasitic on *Coprinus*; Aug., 1923.

Stropharia semiglobata Fr. Common—Pastures on dung; May-Oct.

(5) BLACK SPORED.

Coprinus atramentarius Fr. Common—Lawns or about stumps; May-Oct. Edibility good.

Coprinus comatus Fr. Common—Lawns and open places; Aug.-Oct. Edibility excellent.

Coprinus ebulbosus Pk. Infrequent—On rotting logs and stumps; Don Valley and Klineburg; June-July.

Coprinus fimetarius Fr. Frequent—Pastures and woods on dung; Glen Major and Don Valley; May-Oct.

Coprinus laniger Pk. Infrequent—On rotting wood; Don Valley; June-July.

Coprinus micaceus Fr. Common—On rotting wood; May-Oct. Edibility excellent.

Coprinus niveus Fr. Rare—Open woods on ground; Near King City; Sept., 1932.

Coprinus quadrifidus Pk. Infrequent—In open woods; base of stem showing rhizomorph like a root; Don Valley; Oct., 1931.

Panaeolus campanulatus Fr. Rare—In garden, DeLisle Ave.; July, 1922.

Panaeolus papillionaceus Fr. Rare—Brought to Mycological meeting by Mr. Farmer and vivid account given by him of intoxication he experienced from eating a number of this species.

Panaeolus retirugis Fr. Common—Pastures on dung; May-Sept.

Panaeolus solidipes Pk. Infrequent—Pastures on dung; Don Valley and Humber Valley; July-Sept.

Psathyrella disseminata Fr. Frequent—On lawns and in woods; July-Sept.

POLYPORACEAE

In the Boleti the arrangement by Dr. C. H. Peck has been followed. (Bulletin No. 8, Boleti of the United States.)

Boletinus cavipes Kalchb. Rare—Swamp East of Wilcocks Lake; Sept., 1930.

Boletinus grisellus Pk. Rare—Woods near Kelly Lake; Sept., 1930.

- Boletinus pictus* Pk. Common—Woods on ground; usually near conifers; July-Oct.
- Boletinus porosus* (Berk.) Pk. Rare—University of Toronto grounds; July, 1928.
- Boletinus porosus* var. *opacus* Pk. Common—Woods on ground; Don Valley; July. Edible, very good.
- Boletinus spectabilis*. Rare—Wet woods; Glen Major; July-Sept.
- Boletus americanus* Pk. Common—Open woods under or near pines; July-Oct.
- Boletus awripes* Pk. Rare—Woods on ground; Don Valley; July, 1932.
- Boletus bicolor* Pk. Rare—Woods on ground or well rotted wood; Don Valley; Aug., 1932.
- Boletus clintonianus* Pk. Only specimens seen came from Muskoka and Bobcaygeon; Sept.
- Boletus chrysenteron* Fr. Rare—Woods on ground; Don Valley; Aug., 1932.
- Boletus decorus* Frost. Rare—Woods on ground; Don Valley; July, 1924.
- Boletus edulis* Bull. Infrequent—Open woods; Glen Major; Sept.
- Boletus felleus* Bull. Frequent—Open woods; Bond Lake and Glen Major; July-Aug.
- Boletus flavidus* Fr. Infrequent—Damp woods; Glen Major; Aug.
- Boletus granulatus* Linn. Common—Open woods under or near pines; June-Oct.
- Boletus indecisus* Pk. Frequent—Damp woods on ground; Don Valley and Glen Major; July-Aug.
- Boletus luridus* Schaeff. Collected by F. W. Fraser, Humber Valley; July, 1924.
- Boletus luteus* Linn. Rare—On ground under pines; Don Valley; Oct., 1932.
- Boletus magnisporus* Frost. Collected by F. W. Fraser, Humber Valley; July, 1924.
- Boletus peckii* Frost. Rare—Open woods on ground; Midhurst; July-Sept.
- Boletus piperatus* Bull. Frequent—Woods on ground; Don Valley and Glen Major; July-Sept.
- Boletus punctipes* Pk. Rare—Woods on ground; Bond Lake; Aug., 1929.
- Boletus ravenelii* B. & C. Langton list.
- Boletus russellii* Frost. Infrequent—Open woods; Glen Major; Aug.
- Boletus scaber* Fr. Common—Woods and open places; var. *fuscus* commonest; other varieties found, *testaceus*, *areolatus*, *olivaceus*. Edible, good.

- Boletus subaureus* Pk. Common—On ground in pine woods; Bond Lake and Glen Major; July-Oct.
- Boletus subluteus* Pk. Frequent—On ground in mixed woods; Glen Major; Aug.-Sept.
- Boletus variipes* Pk. Rare—On ground in mixed woods; Glen Major; Aug., 1928.
- Boletus versipellis* Fr. Infrequent—On ground in mixed woods; Bond Lake and Glen Major; Aug. Caps are excellent eating. The tubes and stems of all edible boleti should be removed before cooking.
- Strobilomyces strobilaceus* Berk. Infrequent—Woods on ground; Glen Major; July-Sept.
- Daedalea confragosa* (Bolt.) Fr. Common—On dead or living willow, etc.
- Daedalea quercina* (Linn.) Fr. Frequent—On dead oak, etc.
- Daedalea unicolor* (Bull.) Fr. Common—On dead wood of deciduous trees.
- Favolus canadensis* Klotzsch. Common—On dead branches deciduous trees.
- Fistulina hepatica* Fr. Infrequent—Niagara-on-the-Lake; Aug.-Sept.
- Fomes applanatus* (Pers.) Wallroth. Common—On living and dead deciduous trees and rarely on conifers.
- Fomes fomentarius* (Linn.) Gill. Common—On living and dead deciduous trees.
- Lenzites betulina* (Linn.) Fr. Frequent—On dead deciduous trees.
- Lenzites saepiararia* Fr. Frequent—On dead coniferous wood.
- Merulius niveus* Fr. Infrequent—Brought to Mycological meeting, Sept., 1930; Lorne Park. (Reported by Dr. J. H. Faull).
- Merulius tremellosus* Schrader. Infrequent—On rotting stumps; Bond Lake and Don Valley; Sept.
- Merulius radiatus* Fr. Langton list, as *Phlebia radiata*.
- Polyporus adustus* (Willd.) Fr. Frequent—On dead deciduous trees.
- Polyporus arcularius* (Batsch.) Fr. Common—On dead sticks.
- Polyporus betulinus* Fr. Common—On living or dead birch; Aug.-Nov.
- Polyporus brumalis* Fr. Common—On dead wood. Sept.-Nov.
- Polyporus chioneus* Fr. Common—On dead deciduous branches.
- Polyporus cinnabarinus* (Jacq.) Fr. Common—On dead wood; Aug.-Nov.
- Polyporus distortus* (Schw.) Fr. Langton list.
- Polyporus elegans* (Bull.) Fr. Common—On dead deciduous wood.
- Polyporus fumosus* (Pers.) Fr. Infrequent—On dead deciduous wood; Don Valley.
- Polyporus hispidus* (Bull.) Fr. Infrequent—Brought to Mycological meeting by F. W. Fraser.
- Polyporus lucidus* (Leys.) Fr. Common—On dead hemlock, rarely on other wood.

- Polyporus montagnei* Fr. Rare—On ground in woods; South of Bond Lake; July, 1931.
- Polyporus pargamenus* Fr. Common—On dead wood of deciduous trees.
- Polyporus perennis* (Linn.) Fr. Frequent—On ground in woods, especially burnt places.
- Polyporus picipes* Fr. Common—On dead branches and stumps.
- Polyporus pubescens* (Schum.) Fr. Langton list.
- Polyporus radicans* Schw. Infrequent—On ground about stumps.
- Polyporus resinosus* (Schrader.) Fr. Common—On dead logs and stumps in fall.
- Polyporus schweinitzii* Fr. Rare—At base of pine stump; Aug., 1930.
- Polyporus squamosus* (Huds.) Fr. Frequent—On living and dead deciduous trees.
- Polyporus subradicans* Murr. Rare—Brought to Mycological meeting; Sept., 1922.
- Polyporus sulphureus* (Bull.) Fr. Common—On both living and dead deciduous and coniferous trees. Edible, best stewed.
- Polyporus tulipiferus* (Schw.) Overholts. Langton list as *Irpex lacteus* Fr.
- Polyporus umbellatus* (Pers.) Fr. Rare—On dead stumps; Bond Lake and Glen Major; June-July.
- Polyporus versicolor* (Linn.) Fr. Common—On all kinds of dead wood.

CLAVARIACEAE

- Clavaria aurea* Schaeff. Rare—On ground in mixed woods; Glen Major; Sept., 1926.
- Clavaria cristata* (Holmsk.) Pers. Common—On ground in woods; July-Aug.
- Clavaria fistulosa* Holmsk. var. *ardenia* Atk. Rare—Damp woods near hemlocks; Glen Major; Oct., 1925-1926. Also November, growing through snow in mixed woods near Dwight, Muskoka.
- Clavaria flava* Schaeff. Frequent—On ground in mixed woods; Glen Major; Aug.-Sept.
- Clavaria formosa* Pers. Infrequent—On ground in mixed woods; Glen Major; Aug.-Sept.
- Clavaria fusiformis* Sowerby. Infrequent—On ground in mixed woods; Glen Major; Aug.-Sept.
- Clavaria helveola* Pers. Rare—In moss; Glen Major; Aug., 1929.
- Clavaria inaequalis* Müller. Rare—Brought to Mycological exhibit; Sept., 1925.
- Clavaria kunzei* Fr. Rare—Mixed woods on ground; Don Valley; Aug., 1932.

- Clavaria ligula* Schaeff. Frequent—Under pines; Bond Lake; Aug.-Sept.
Clavaria muscoides Linn. Rare—In grass, pasture near woods; Glen Major; Oct. 2, 1932.
Clavaria obtusissima Pk. Rare—Brought to Mycological meeting; Oct., 1924.
Clavaria pistillaris Linn. Infrequent—On ground in woods; Glen Major; Aug.-Oct.
Clavaria pyxidata Pers. Frequent—On rotting logs; Glen Major; July.
Clavaria vermiculata Micheli. Infrequent—Woods on ground; Don Valley and Glen Major; July-Sept.
Physalacria inflata Schw. Langton list. Krieger says this holds a primitive place in the Agaricaceae.

THELEPHORACEAE

- Craterellus cornucopioides* Linn. Rare—Humber Valley; Sept., 1923.
Craterellus lutescens (Pers.) Fr. Rare—On ground in wet woods; Glen Major and Midhurst; Aug.
Hymenochaete tabacina Sow. Langton list as *Stereum tabacinum* Fr.
Stereum diaphanum (Schw.) Cke. Rare—On ground in grass; near King City; Aug., 1931.
Stereum frustulosum (Pers.) Fr. Langton list.
Stereum gausapatum Fr. Langton list as *Stereum spadiceum* Fr.
Stereum hirsutum Fr. Langton list.
Stereum rufum Fr. Langton list.
Stereum sericeum Schw. Langton list.
Stereum versicolor Fr. Langton list.
Thelephora schweinitzii Pk. Frequent—Woods South of Bond Lake; Aug.
Thelephora terrestris (Ehrh.) Fr. Common—On ground in open woods; Don Valley; May-Aug.

HYDNACEAE

- Hydnum velutinum* Fr. Rare—On ground in woods; Glen Major; Aug., 1931.
Hydnum zonatum Fr. Rare—On ground; Don Valley; Aug., 1932.
Hydnum albonigrum Pk. Langton list.
Hydnum auriscalpium Linn. Brought to Mycological meeting; July, 1928.
Hydnum caput-medusae Bull. Frequent—On living and dead deciduous trees; Sept.-Oct.
Hydnum caput-ursi Fr. Frequent—On living and dead deciduous trees;

Sept.-Oct. Above two are probably forms of same species. Both good edible species.

Hydnum coralloides Scop. Frequent—On dead deciduous wood; Aug.-Oct. Edible, excellent.

Hydnum erinaceum Bull. Infrequent—On dead deciduous wood; Erin-dale; Sept.

Hydnum pulcherrimum B. & C. Rare—On dead log; Don Valley; Dec., 1932.

Hydnum repandum Linn. Common—On ground in woods; July-Oct.

Hydnum septentrionale Fr. Infrequent—On living maples; Glen Major; Aug.

(Recent authors have segregated these *hydnums* into several genera.)

TREMELLALES

Exidia gelatinosa (Bull.) Schroet. Frequent—On bark of fallen branches; May.

Exidia glandulosa (Bull.) Fr. Common—On fallen branches; Nov.

Gyrocephalus rufus (Jacq.) Bref. Common—Moist ground in woods and open places; July-Nov.

Naematelia nucleata (Schw.) Fr. Common—On dead wood and bark; May.

Tremella frondosa Fr. Langton list.

Tremella reticulata (Berk.) Farlow. Infrequent—On ground in damp woods; Don Valley; Aug.-Sept.

Tremellodendron candidum (Schw.) Atk. Common—In woods; Don Valley; July-Sept.

Tremellodon gelatinosum (Scop.) Pers. Rare—On rotting pine; Don Valley; Aug., 1930.

DACRYOMYCETALES

Dacrymyces aurantius (Schw.) Farlow. Common—On bark of dead pine; Aug.-Oct.

GASTEROMYCETES

PHALLACEAE

Dictyophora duplicata (Bosc) E. Fischer. Rare—On ground in woods; Don Valley; Sept., 1924.

Ithyphallus impudicus (Linn.) Fr. Langton list. W. C. Coker says a rare plant east of the Mississippi and early records doubtful.

Ithyphallus ravenelii (B. & C.) E. Fischer. Common—On ground in woods; Sept.-Oct.

Mutinus ravenelii (B. & C.) E. Fischer. Rare—Brought to Mycological meeting; July, 1920.

LYCOPERDACEAE

Bovista pila B. & C. Infrequent—Pastures; Midhurst and Minising; Aug.
Bovista plumbea Pers. Frequent—Pastures; Bond Lake and Don Valley; Sept.-Oct.

Calvatia caelata (Bull.) Morg. Infrequent—Pasture; Don Valley near Donalds Farm; June-Sept.

Calvatia cyathiformis (Bosc) Morg. Common—Pasture; July-Oct.
Edible, excellent.

Calvatia maxima (Schaeff.) Morg. Common—Pasture; July-Oct.
Edible, excellent.

Geaster coronatus (Schaeff.) Schroet. Rare—Woods; Bond Lake; Sept., 1932.

Geaster fornicatus Fr. Rare—On ground in cedar woods; Glen Major; Aug., 1929.

Geaster hygrometricus Pers. Common—Ground in rich woods; Glen Major; July-Sept.

Geaster limbatus Fr. Langton list.

Geaster triplex Jung. Common—On ground in woods; Aug.-Sept.

Lycoperdon curtisii Berk. Common—Pastures and grassy places; July-Oct.

Lycoperdon gemmatum Batsch. Common—On rotting wood and ground; Aug.-Oct. Edible, good.

Lycoperdon marginatum Vitt. Frequent—Open places and old plowed land; Midhurst; Aug.-Sept.

Lycoperdon pyriforme Schaeff. Common—On rotting wood; July-Oct.
Edible, good.

SECOTIACEAE

Secotium agaricoides (Czern.) Hollós. Frequent—Pastures; Glen Major and Midhurst; Aug.-Oct.

SCLERODERMATACEAE

Scleroderma aurantium (Vaill.) Pers. Common—On rotten wood; Aug.-Sept.

Scleroderma lycoperdoides Schw. Infrequent—On ground in woods; Don Valley and Glen Major; July.

TYLOSTOMATACEAE

Tylostoma campestre Morg. Rare—In sandy soil; Kelly Lake; Sept.-Oct.

NIDULARIACEAE

Cyathus vernicosus De C. Common—On ground in and near woods; Sept.-Oct.

ASCOMYCETES

HELVELLALES

HELVELLACEAE

Gyromitra gigas Cke. Infrequent—On ground under conifers; Don Valley; May.

Gyromitra esculenta Fr. Frequent—On ground near pines; Port Credit and Glen Major; Apr.-June. Many persons have eaten this fungus and felt no injurious effects but there are well authenticated cases of serious illness and even of fatal poisonings produced by it.

Gyromitra sphaerospora Sacc. Langton list.

Helvella atra Koenig. Langton list.

Helvella crispa Fr. Infrequent—On ground in woods; Don Valley and Glen Major; Aug.-Oct.

Helvella elastica Bull. Infrequent—On ground in woods; Midhurst and Glen Major; July-Aug.

Helvella infula Schaeff. Langton list.

Helvella mitra Linn. Infrequent—On ground at edge of woods; Glen Major; Aug.

Morchella angusticeps Pk. Frequent—On ground, generally near pines; May.

Morchella conica Pers. Frequent—On ground in woods and open places; May.

Morchella crassipes Pers. Infrequent—On ground in woods and open places; May-June.

Morchella deliciosa Fr. Frequent—On ground in woods and open places; May.

Morchella esculenta Pers. Common—On ground in woods and open places; Apr.-June.

Morchella hybrida Pers. Rare—On ground in woods; Don Valley; May, 1931. Have eaten all species of *Morchella* and they are all excellent.

- Verpa bohemica* Schröt. Frequent—On ground in woods; May. Edible, excellent.
Verpa conica Schwartz. Rare—On ground near woods; Don Valley; May, 1923.

GEOGLOSSACEAE

- Geoglossum glabrum* Pers. Frequent—On rotting logs; Bond Lake and Glen Major; July-Sept.
Geoglossum intermedium Dur. Langton list, as *Geoglossum intermedium* Dur.
Geoglossum difforme (Fr.) Dur. Langton list.
Geoglossum glutinosum (Pers.) Dur. Frequent—On rotting wood; Glen Major; Aug.-Sept.
Leotia chlorocephala L. & S. Langton list.
Leotia lubrica (Scop.) Pers. Frequent—On ground in damp woods; Aug.-Sept.
Microglossum rufum (L. & S.) Underw. Frequent—On rotting wood and humus; July-Sept.
Spathularia clavata (Schaeff.) Sacc. Infrequent—On ground under pines; Glen Major; Aug.-Sept.
Trichoglossum hirsutum (Pers.) Boud. Langton list.

PEZIZALES

OPERCULATAE

- Alewria aurantia* (Pers.) Fuckel. Infrequent—Woods on clay ground; Don Valley; Oct.
Discina ancilis (Pers.) Sacc. Rare—On well rotted wood; Don Valley; May, 1932.
Discina convoluta Seaver. Rare—On rotting pine root; Don Valley; May, 1932.
Patella scutellata (L.) Morg. Langton list, as *Peziza scutellata* Linn.
Paxina acetabulum (L.) Kuntze. Rare—Woods on ground; Don Valley and Dundas Marsh; May-July.
Paxina corium (Weberb.) Seaver. Rare—Sandy soil; Wilcocks Lake; July, 1932.
Peziza badia Pers. Frequent—On ground in woods; Don Valley; May-June.
Peziza repanda Pers. Frequent—On rotting wood; Don Valley; June-Sept.

Peziza sylvestris (Boud) Sacc. and Trott. Frequent—On ground in rich woods; Don Valley; May-June.

Peziza venosa Pers. Rare—On ground in woods; Don Valley; June, 1932.

Peziza vesiculosa Bull. Infrequent—On ground in woods; Don Valley, May.

Plectania coccinea (Scop.) Fuckel. Common—On buried sticks; Apr.-May. Dec. 26, 1932, found after week of mild weather; one specimen two inches wide.

Scodellina leporina (Batsch.) S. F. Gray. Rare—On ground in woods; Aug., 1924.

Urnula craterium Fr. Rare—On damp sticks; Dundas Marsh; May, 1930.

INOPERCULATAE

Cenangium populneum (Pers.) Rehm. Common—On poplar sticks; May.

Chlorosplenium versiforme (Pers.) de Not. Langton list.

HYPOCREALES

Hypomyces lactifluorum Schw. Frequent—On *Lactarius piperatus*; July-Sept. Edibility good.

SPHAERIALES

Daldinia concentrica (Bolt.) Ces. & de Not. Common—On rotting wood.

Hypoxylon coccineum Bull. Langton list.

Xylaria polymorpha Grev. Common—At base of rotting stumps; July-Sept.

BIBLIOGRAPHY

- ATKINSON, GEO. F.—*Mushrooms Edible, Poisonous, etc.*, 3rd Ed., 1911.
 BEARDSLEE, H. C.—*The Russulas of North Carolina*, Jour. E. Mitchell Sci. Soc. Vol. 33, No. 4, January, 1918.
 BISBY, G. R., BULLER, A. H. R., DEARNESS, JOHN.—*The Fungi of Manitoba*, 1929.
 BURT, E. A.—*The North American Species of Clavaria*, 1922.
 BURT, E. A.—*Merulius in North America*, 1917.
 COKER, W. C.—*The Clavarias of the United States and Canada*, 1923.
 COKER, W. C.—*Craterellus, Cantharellus, and Related Genera in N. Carolina*, Jour. E. Mitchell Sci. Soc., Vol. 35, Nos. 1 and 2, October, 1919.
 COKER, W. C.—*The Amanitas of the Eastern United States*, Jour. E. Mitchell Sci. Soc., Vol. 33, Nos. 1 and 2, June, 1917.
 COKER, W. C.—*The Lactarias of North Carolina*, Jour. E. Mitchell Sci. Soc., Vol. 34, Nos. 1 and 2, June, 1918.

- COKE, W. C.—*The Hydnums of North Carolina*, Jour. E. Mitchell Sci. Soc., Vol. 34, No. 4. March, 1919.
- COKE, W. C.—*Notes on the Lower Basidiomycetes of North Carolina*, Jour. E. Mitchell Sci. Soc., Vol. 35, Nos. 3 and 4. June, 1920.
- COKE, W. C.—*Notes on the Thelephoraceae of North Carolina*, Jour. E. Mitchell Sci. Soc., Vol. 36, Nos. 3 and 4. February, 1921.
- COKE, W. C. and COUCH, J. N.—*The Gasteromycetes of Eastern United States and Canada*, 1928.
- COOKE, M. C.—*Handbook of British Fungi*, 2 Vols., 1871.
- COOKE, M. C.—*British Edible Fungi*, 1891.
- DURAND, E. J.—*The Geoglossaceae of North America*, 1908.
- GIBSON, W. H.—*Our Edible Toadstools and Mushrooms*, 1895.
- GUSSOW, H. T. and ODELL, W. S.—*Mushrooms and Toadstools*, 1927.
- HARD, E. M.—*Mushrooms, Edible and Otherwise*, 1908.
- KAUFFMAN, C. H.—*The Agaricaceae of Michigan*, 2 Vols., 1918.
- LANGTON, THOS.—*Partial List of Fungi to be found near Toronto*, Natural History Toronto Region, 1913.
- MARSHALL, NINA L.—*The Mushroom Book*, 1905.
- MCDUGALL, W. B.—*Mushrooms*, 1925.
- MCLLVINE, CHAS and MACADAM, R. K.—*One Thousand American Fungi*, New Ed., 1912.
- NEUMAN, J. J.—*The Polyporaceae of Wisconsin*, 1914.
- North American Flora*, Vol. 9. Agaricales. Various Authors.
- North American Flora*, Vol. 10, Parts 1 to 5. Agaricales. Various Authors.
- ODELL, W. S.—*List of Mushrooms and other Fleshy Fungi of the Ottawa District*. Museum Bull. No. 43, 1926.
- ODELL, W. S.—*List of Mushrooms and other Fleshy Fungi of the Ottawa District*. (Supp. list) Can. Field Nat., Vol. 45, Page 139. Sept., 1931.
- OVERHOLTS, L. O.—*A Monograph of the Genus Pholiota in the United States*, 1927.
- OVERHOLTS, L. O.—*Polyporaceae of the Middle Western United States*. Washington University Studies, Vol. 3, Pt. 1, No. 1. July, 1915.
- PECK, C. H.—*New York State Museum Reports and Bulletins*, 1865 to 1912.
- REA, CARLETON—*British Basidiomycetae*, 1922.
- ROLFE, R. T. and F. W.—*The Romance of the Fungus World*, 1925.
- SEAYER, F. J.—*The North American Cup-fungi (Operculates)*, 1928.
- STONE, R. E.—*Common Edible and Poisonous Mushrooms of Ontario*, 1923.
- SWANTON, E. W.—*Fungi and How to Know Them*, 1909.
- TAYLOR, THOS.—*Students' Handbook of Mushrooms of America*, 1897.

Toronto, Ont., August, 1933.

[illegible]

MGIPC-S5-38 AB/34-7-7-54-7,000.-